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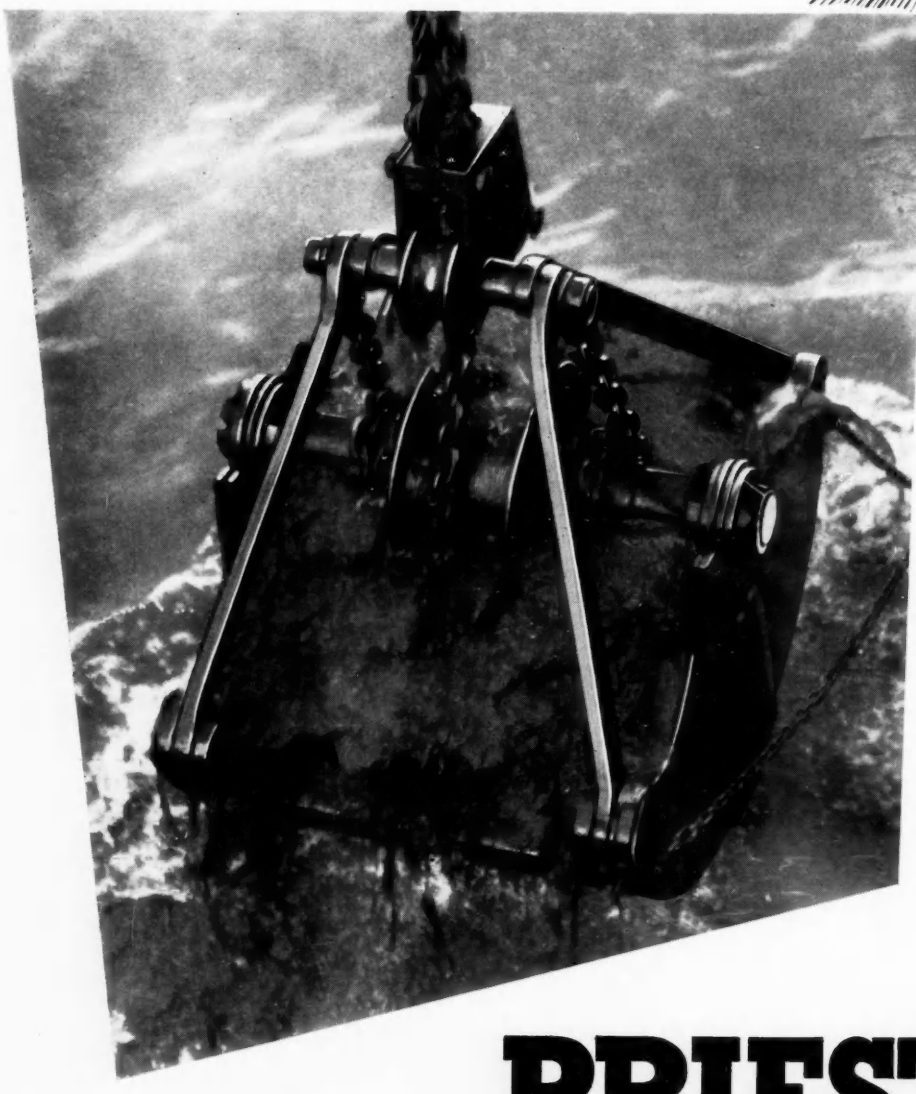

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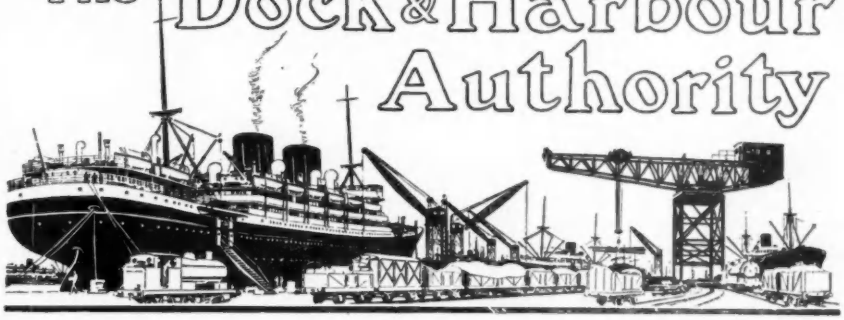

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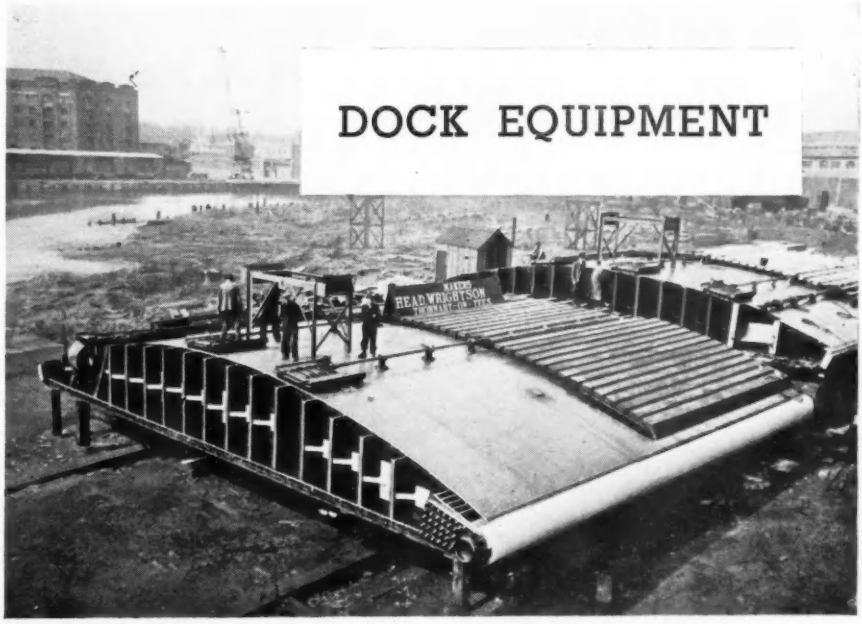

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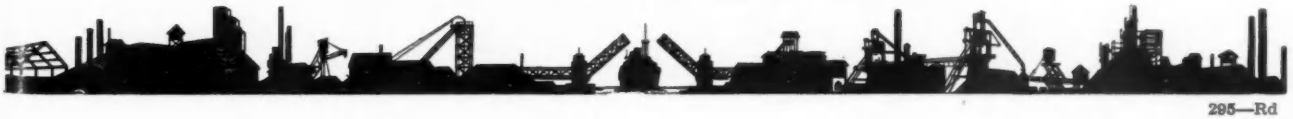

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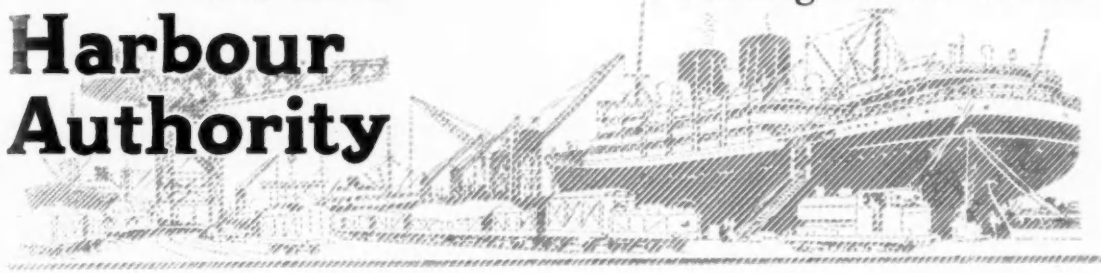


No. 418

Vol. XXXVI.

AUGUST, 1955

Monthly 2s. 6d.

Editorial Comments

Port Esquivel, Jamaica.

A new industry which is likely to have far reaching effects on the future prosperity of Jamaica has resulted from the discovery, in 1938 and succeeding years, of large deposits of bauxite, rich in iron but generally low in silica with an alumina content ranging around 50 per cent.

In view of the demand for alumina during the Second World War, energetic steps were taken to develop this valuable discovery as a war emergency project. In 1943, Aluminum Limited—a Canadian Company—organised Jamaica Bauxite Ltd. (later renamed Alumina Jamaica Ltd.) as a fully owned subsidiary, but it was found that the highly ferruginous Jamaican ore could not be treated economically in the existing North American plants without special modifications of equipment and practice. It therefore was not until the conclusion of hostilities that long-term planning for peacetime development could be undertaken.

Jamaica is not endowed with water power resources that would make aluminum production feasible in the Island. It was therefore decided to send bulk supplies of the ore to the new manufacturing plant at Kitimat, British Columbia. Readers will remember that a description of the new port at Kitimat was featured in this Journal in our issue for February last.

As every shipper and manufacturer knows, however, the transport of commodities to distant markets demands a very careful analysis of freight costs. It was found that to ship the ore as a raw material to Canada was uneconomic, but if it was processed through its first stages of manufacture there would be a saving of more than 60 per cent. in shipping space. Accordingly a processing plant was constructed at Kendal, Jamaica, and a modern terminal, specially equipped for bulk loading, was built at Port Esquivel, some 30 miles distant.

A description of the maritime engineering works connected with the construction of this new port will be found on a following page. The port installations cover an area of 35 acres and two ships of 10,000 tons can be handled simultaneously. With possible future developments in view, facilities have also been provided to handle all types of cargo, both inward and outward.

The British Transport Commission and British Waterways.

In our last issue, we commented upon the present position and possible future trends in the policy of the transport undertakings of the British Transport Commission. An article in that issue reviewed the Annual Report of the Commission and emphasised the preponderant influence of railway interests within the Commission, particularly in the light of the Government decision to dispose of the bulk of the road haulage undertaking, under the 1953 Transport Act. The effective result of this decision was to put an end to any idea of integration of rail, road and inland waterways haulage operations, with the compensating intention of injecting renewed enterprise, inspired by competition. In consequence it seemed that the Commission would become, to all intents and purposes, a railway concern, with policy decisions exclusively formulated in the light of the success or failure experienced on the railways.

However, the Minister of Transport announced on July 21st that British Road Services were to retain the trunk haulage fleet within the orbit of the Commission. He has asked the Disposals Board to advise him on the number of vehicles involved; it is thought that an increase to a total of 8,000 vehicles retained by the Commission is probable. The decision to leave the main trunk fleet with Commission has been generally welcomed, as it should give the road haulage industry some greater stability. This decision will also assist in counteracting the tendency for the Commission to be regarded and to consider itself as a purely railway concern, with a few ancillary services associated. This may give an opportunity for British Waterways to pursue a more independent policy, and we hope that this will amount to something more than the retention of those waterways at present operating profitably, accompanied by the disposal of the remainder. Even if some of the narrow canals are so aligned that their resuscitation is beyond hope, there are many water routes which could, with considerable civil engineering work, be developed until they provide some welcome relief to the overloaded roads in Great Britain.

Development of Inland Waterways.

Whilst the future of British inland waterways continues to attract considerable public attention, there are few signs that any extensive modernisation plans will be undertaken. On the other hand, the proportion of traffic carried by inland waterways on the continent of Europe increases steadily. A recent published report of the situation in Belgium shows that plans include the widening and deepening of many canals to accommodate craft of 1,350 tons capacity, and particularly to improve canal communication between the industrial inland area of Hainault and Brussels and the sea. The average freight rate per ton-kilometre by canal is 0.38 Belgian francs by barge, compared with 0.90 francs by rail and 2.2. francs by 10-ton motor lorry.

The attitude of the British Transport Commission towards modernisation remains something of an enigma. Officially the recommendations of the Board of Survey are endorsed; these included the transfer of certain waterways upon which there is no traffic except pleasure boats to other authorities; at the same time no extensive modernisation of other waterways was advised. However, there also appears to be some official sympathy for an alternative policy, vigorously advocated in some quarters, of restoring to good order every waterway in the country, regardless of the traffic economics. Furthermore, although welcome in many ways, a recently announced decision to reduce charges to pleasure traffic (in cases where the locks are used and hence must be maintained in working order, even if no commercial traffic uses the particular canal) is surprising from an undertaking which operates at a substantial loss. The risk, of course, is that the Commission's maintenance facilities may be increasingly occupied on routes suitable for pleasure traffic, and hence urgent maintenance elsewhere may be delayed. There is also a possible objection that pleasure traffic may cause delays to commercial boats on the busier routes, although efficient management should be able to prevent this becoming a serious difficulty. Unfortunately, even if the reduction in pleasure boat charges increases revenue from this

Editorial Comments—continued

source, there seems little hope that the income so produced will be more than a negligible fraction of total receipts.

Meanwhile public interest has been inspired by the courageous legal action of a private commercial canal carrier on the little used Kennet and Avon canal. The case is due to be heard in October, but an application for an interim injunction to restrain the Commission from causing further deterioration of the canal has just been heard and rejected. The history of commercial traffic on this canal has been an unhappy one, and it is open to question whether this particular route is one fit for modernisation to economic standards. However, the forthcoming action will stimulate further interest and may well have far reaching effects.

Pollution of Waterways.

In our last issue we published an article by Dr. J. Grindley of the Water Pollution Research Laboratory reporting upon some research into the extent and effect of pollution in the Thames Estuary. This month we publish a report of a paper by Mr. C. Lofthouse, delivered before the Royal Sanitary Institute, which also deals with this subject. The progressive deterioration in the condition of water in rivers and waterways, especially in industrial areas, is causing increasing concern. Sewage and industrial effluents, together with flue gas washings are making such demands on the oxygen content of rivers that complete deoxygenation occurs at times. Acids and other deleterious matter in the water and mud on the foreshore are causing rotting of underwater planking at an unprecedented rate, and difficulty has been experienced in finding a paint which will stand up to the effects of gases evolved from polluted water. Dr. Grindley's article was especially concerned last month on the quantity and nature of the gases arising from polluted waters, and these articles should serve to direct attention to this difficult problem.

A further aspect of pollution relates to the rise in temperate of the water, where power stations and other industrial users abstract water from rivers and canals and return them at a higher temperature. The problems involved demand serious consideration by waterway authorities who are anxious to attract industrial users to their banks and thus obtain waterborne traffic. In the first place, if the water temperature as a whole is raised substantially, the advantage of a plentiful supply of cool water is prejudiced; one new large power station sited close to other users of cooling water may so raise the temperature of the water that they may be forced to make other arrangements for their cooling processes, with resultant loss of revenue to the waterway authority and possible ultimate loss of waterway traffic. This is a particularly serious problem for cold storage undertakings, since the operation of refrigerating plant is extremely sensitive to cooling water temperature. Secondly, the rise in temperature of the water can cause difficulties to navigation due to fog formation. Thirdly, if the water is severely polluted chemically, the extent of corrosion of plant such as condensers may itself be sufficiently acute to cause operators of industrial plant to seek alternative cooling means. The extent of silt suspension in the water is another variable factor. The problems are thus incapable of solution independently, and they are further associated with those of navigation and traffic, because, if a good channel is maintained to permit traffic, an improvement in water condition is likely automatically to occur.

Helicopter Services in Port Areas.

In view of the expected increasing use of helicopters in port areas, some features of the service recently introduced between London Airport and Waterloo Air Terminal are of topical interest. The saving of passenger's time by the use of air travel, as an alternative to cross-channel sea services, is usually much reduced by the road journey through urban areas. When helicopters can be used a considerable saving in the transit time between town and airport can be achieved.

The service to and from London Airport is still in the nature of an experiment, which is expected to cost the Ministry of Transport £300 per day. Eight flights daily are planned each taking 15 minutes, for a charge of 35s. instead of at least an hour by road costing 5s. The Westland Aircraft Company, manufacturers of these helicopters under licence from the Sikorsky Company of America, have successfully modified the machines to meet the needs of these flights, along a route which follows the River Thames for much of the way. The modifications include engine silencers, floats to permit forced landings on the Thames and anchors to comply with Port of London regulations about drifting craft. Unfortunately, these additions have reduced the passenger pay load from twelve to a maximum of five into London and to two or three from London. At the present stage of development the advantage to passengers is slight, since the Airways authority are not in a position to guarantee seats. Nevetheless, this is a development which must be kept under review, not only due to the impact of air services on other means of passenger travel, but also because port authorities in all parts of the world will be facing problems arising from the use of these low flying aircraft in the neighbourhood of docks.

Infestation Control.

In this issue appears the seventh and final article in the series "Commodity Infestation in Ports." The author, Mr. McAuley Gracie, was one of the first to draw attention to the appalling loss to the country's food supplies caused by the depredations and ravages of insect pests and vermin. From 1941 to 1952 he was Director of the Infestation Control Division of the Ministry of Food which was specially created, in the first place, as a war-time expedient, but which subsequently has been continued as part of the Ministry of Agriculture and Fisheries.

In view of the world-wide implications of pest control and food contamination, we hope to publish at a later date, a further series on this subject, when Mr. McAuley Gracie will deal with the international aspect of infestation, particularly as it affects ports outside the United Kingdom.

Dock Labour Scheme Inquiry.

In view of the recent comments in these columns upon the need for investigation into the causes of strikes and unrest in the docks, the announcement that Sir Walter Monckton, the Minister of Labour and National Service, has appointed a Committee of Enquiry into the Dock Labour Scheme is welcome.

It will be recalled that Sir Walter Monckton stated in the House of Commons on 21st April last, that he had decided to set up the Committee but the appointment was temporarily postponed because a dock strike was in progress.

For some time past, it has been realised by many interests in the dock industry that there were difficulties in making the present scheme function satisfactorily. Last November the subject was debated in the House of Lords when Lord Ammon urged that the degree of industrial unrest which had been experienced in the docks in recent years suggested that the time had come when there should be a general review of the scheme.

The Earl of Munster, replying on behalf of the Government, said that, in the Government's view it was premature to consider an immediate enquiry into the industry, but that it was the intention of the Minister of Labour and National Service to discuss with representatives of the Port Industry the operation of the scheme.

Subsequently discussions took place between officials of the Ministry and represenatives of the Employers' side and of the Workers' side of the National Joint Council of the Port Transport Industry, and with representatives of the trade unions of the industry not represented on the National Joint Council.

The terms of refereace of the Committee now appointed are "to inquire into the working of the Dock Labour Scheme and to advise what alterations, if any, should be made in the terms of the Scheme." The Hon. Mr. Justice Devlin, a Judge of the High Court, has been appointed Chairman of the Committee, and the other members are: Mr. J. A. Birch, General Secretary of the Union of Shop, Distributive and Allied Workers; Sir Frederick Rees, formerly Vice-Chancellor of the University of Wales; Professor J. C. Smith, formerly Professor of Finance and Dean of the Faculty of Commerce, Birmingham University; Mr. A. B. Waring, Chairman and Managing Director of Joseph Lucas (Industries) Ltd. The Secretary is Mr. W. A. Treganowan of the Ministry of Labour.

It has subsequently been announced that any organisation or person wishing to submit evidence to the Committee should get in touch with Mr. W. A. Treganowan at 8, St. James' Square, London, S.W.1.

Port Esquivel, Jamaica, B.W.I.

A Shipping Terminal for Bulk Alumina

By L. E. STEPHENSON, P.E., Assoc. M. A.S.C.E.
Vice-President, Frederick Snare Corporation, New York.

PORT ESQUIVEL, an entirely new port on the south coast of Jamaica, B.W.I., especially engineered for the shipping of alumina in bulk, has now become a completed and functioning part of the tremendous expansion program of Aluminium Limited of Canada. Through this port will be shipped the aluminium oxide, or alumina, which is destined for final processing into aluminium billets in the new smelters at Kitimat, British Columbia.

In 1942, with the discovery that much of the abundant but rather unfertile red earth of Jamaica was, in fact, valuable bauxite ore, explorations and the acquisition of mining properties were initiated by Aluminium Limited, closely followed by certain aluminium companies of the United States. However, it was not until after World War II that it was possible to undertake the detailed engineering work necessary for the mining, processing plant, port works and other facilities. Aluminium Laboratories Limited, the subsidiary of Aluminium Limited responsible for research, engineering and geological exploration, began active long range planning of the various operational facilities in 1946. At this time, investigations and studies for a port and shipping terminal facilities were entrusted to the Frederick Snare Corporation, whose engineers practically encircled the island in search of the most satisfactory location for the proposed port.

In 1951 a decision was finally reached to locate the port at a place indicated on maps of Jamaica as "Longs Wharf," but which was then only a stretch of lonely sandy beach on Old Harbour Bay. In addition to the excellent natural protection afforded to navigation at this site, the land here is generally level, and relatively accessible to the main line tracks of the railroad and to main highways. The alumina plant at Kendal, elevation about 1,300 feet, is about 30 miles west of the new port by rail. Kingston, capital of Jamaica and its principal city, seaport and airport, is about 22 miles east of the port.

In August 1951, Aluminium Laboratories engaged the services of Frederick Snare Corporation for the final engineering work required in connection with the complete port works and shipping terminal facilities construction as follows:

1 Site investigations, contract drawings and specifications, bid forms, etc., for the dredging of an entrance channel and the docking and turning basin, and for the placing of hydraulic fill to reclaim certain shore front areas and to raise the general elevation of the terminal site.
2 Investigations in detail of conditions at the port site necessary for the design of all facilities, including topographic and hydrographic surveys, borings and other soil and subsurface investigations, meteorolgical data, and the tides, currents, storm waves and other conditions affecting navigation.
3 Engineering for the complete port works and shipping terminal facilities, including designs, contract drawings and specifications, cost estimates and related duties in connection with the project construction.

The general planning for the layout of facilities and the operations at Port Esquivel, are predicated on the following principal conditions:

1 The bauxite ore mined in the Mandeville-Kendal area, to be processed through the first step or chemical precipitation process at the new Kendal plant. The aluminium concentrate or alumina thus produced for export is a white, fine grained, very hard, abrasive, dusty, free flowing, non-hygroscopic mineral, having a weight about 55 to 58 lbs./c.f. Approximately 3 pounds of the bauxite ore is required to produce one pound of the alumina, hence the economy of shipping the concentrate instead of the ore for long distances.
2 The alumina to be transported in bulk from the process plant at Kendal to Port Esquivel, in specially designed bottom dump, covered, standard gauge aluminium railroad hopper cars, 65 short tons capacity, and to be placed in storage silos at the port.
3 The alumina to be handled in bulk from the storage silos into the ships' holds for transport prinicipally to Kitimat, British Columbia.
4 Other requirements were to provide facilities for the export shipment of molasses, the import and storage of Bunker C. fuel oil and soda ash; also to make provision for possible future buaxite export shipments, and for bagging and shipping out bagged alumina.

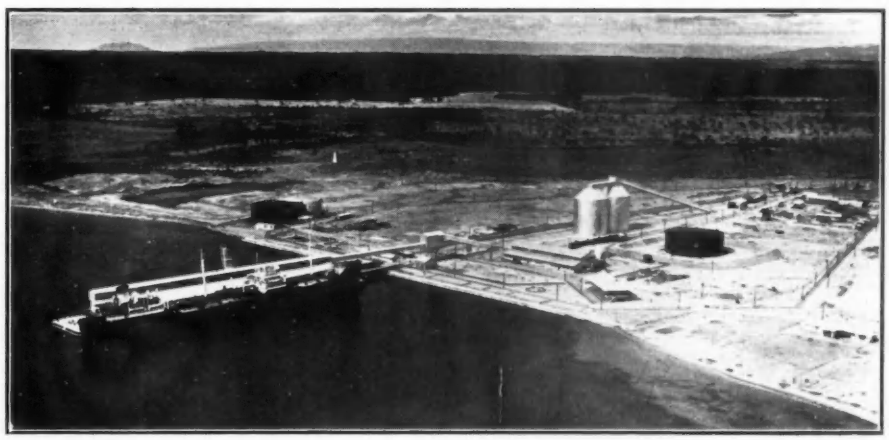
Principal Terminal Facilities

Port.

Although the port site is very well protected and may be considered an all weather port, dredging was necessary to provide sufficient depth of water for the large, ocean-going ships expected to use the port. An entrance channel 400 feet wide and about 6,500 feet long, and a turning basin and pier area 1,350 feet wide by 2,400 feet long, was dredged to provide 32 feet minimum depth of water at mean low tide. The entrance channel is oriented so as to be directly in line with the prevailing winds. Marker buoys are provided to indicate the limits of the dredged channels and also as a guide to the pilot on an incoming ship, as to where he should drop anchor on approaching the pier. A ship then swings on its bow anchor into final mooring position alongside the pier, with the bow to seaward for ease in departure.

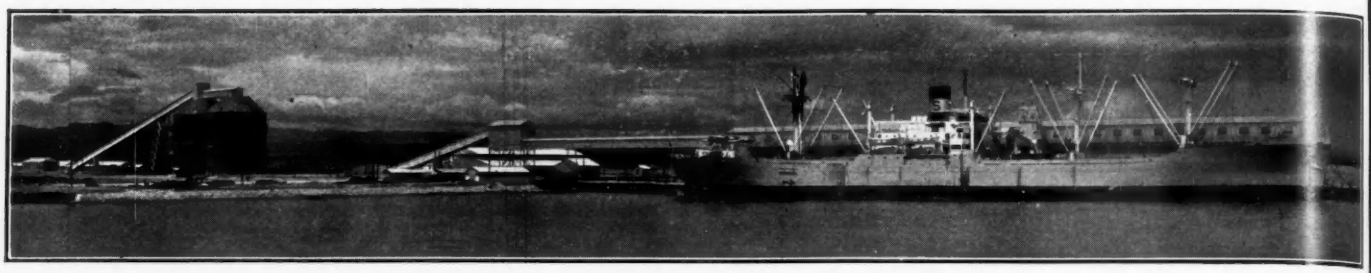
Pier.

The pier has an overall length of 647 feet with the deck located 8 feet above mean sea level. The main portion of the pier is 542 feet long by 88 feet wide. It is connected to shore by an approach trestle 105 feet long by 31 feet wide which provides for railroad and motor truck access to the transit shed and ships' side. Maximum tidal range is



Old Harbour Bay, Jamaica (Port Esquivel).

Port Esquivel, Jamaica, B.W.I.— continued



View of completed Shipping Terminal, Port Esquivel.

about 18-in. Design of the pier consists of an all reinforced concrete deck supported by broad flange steel piles which are driven in transverse bents spaced at 15 feet centre to centre. Each bent consists of 13 vertical piles and 2 inclined piles, all piles being 14-in. x 12-in. x 13/16-in. special web and flange thickness. Bearing piles were driven to 50 short tons (100,000 lb.) safe bearing capacity. Due to the nature of the sub-soil, lagging was added to most of the piles in order to increase the bearing capacity and conserve the quantity of piling material required. Splices were 100% electric arc welded butt joints. All piles are provided with concrete jacket protection from 2 feet below mean sea level to the underside of the concrete deck. The fender system consists of steel piles which are 10-in. x 10-in. x 62.63 pound broad flange beams, driven to 15 feet minimum penetration, and with wood fendering of Greenheart above water level.

Transit Shed.

This building located on the pier is 450 feet long by 40 feet wide, of structural steel framing and corrugated aluminium roofing and siding. Building bays are 15 feet to correspond with the spacing of the pile bents in the pier. A conveyor gallery mounted at the peak of the roof extends the full length of the building. Rolling shutter cargo doors of galvanised iron, with hand chain operators are provided in alternate bays along both sides of the building. All windows have aluminium frames.

Alumina Storage Silos.

The initial installation consists of two silos with a gross capacity of about 23,000 long tons. Provision has been made to permit doubling these storage facilities for the ultimate plant. Each silo is of steel plate welded construction, 78 feet diameter by 82 feet height at each side, and with a truncated cone roof extending the total height to 103 feet. The silos are supported by a concrete mat and pile foundation, which also serves as the floor of the silos. A tunnel of reinforced concrete for the reclaiming belt conveyor is built integrally with the silo foundations, and designed to serve the two present plus two future silos.

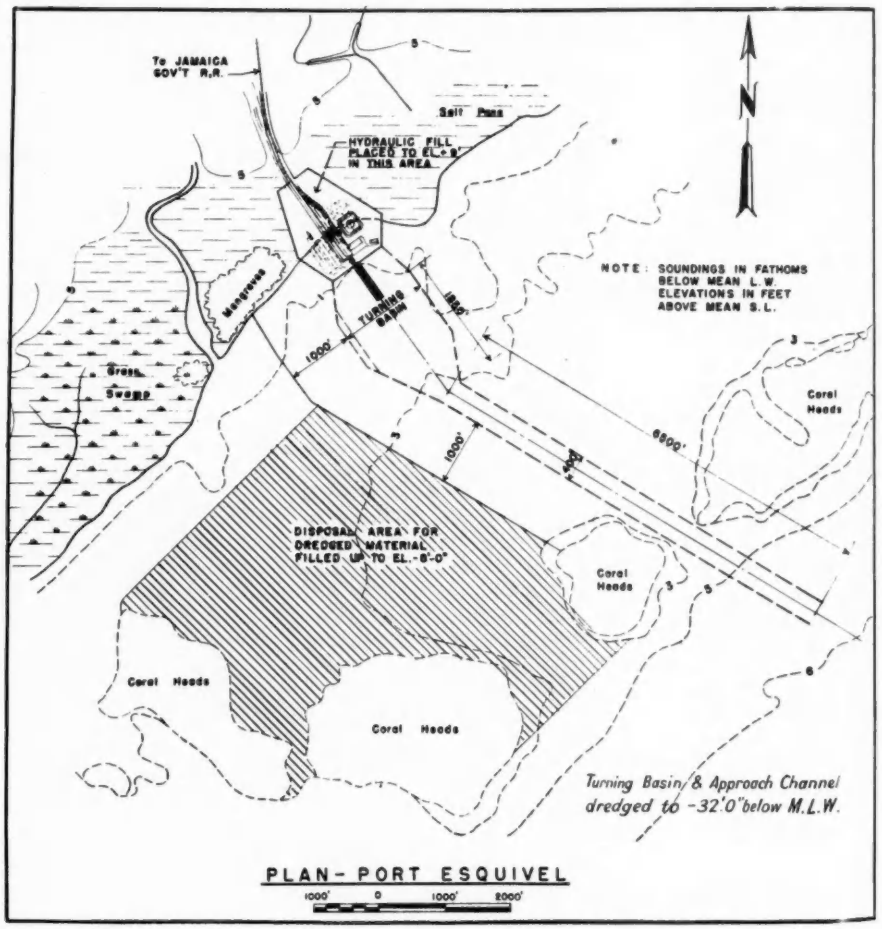
Alumina Transport System.

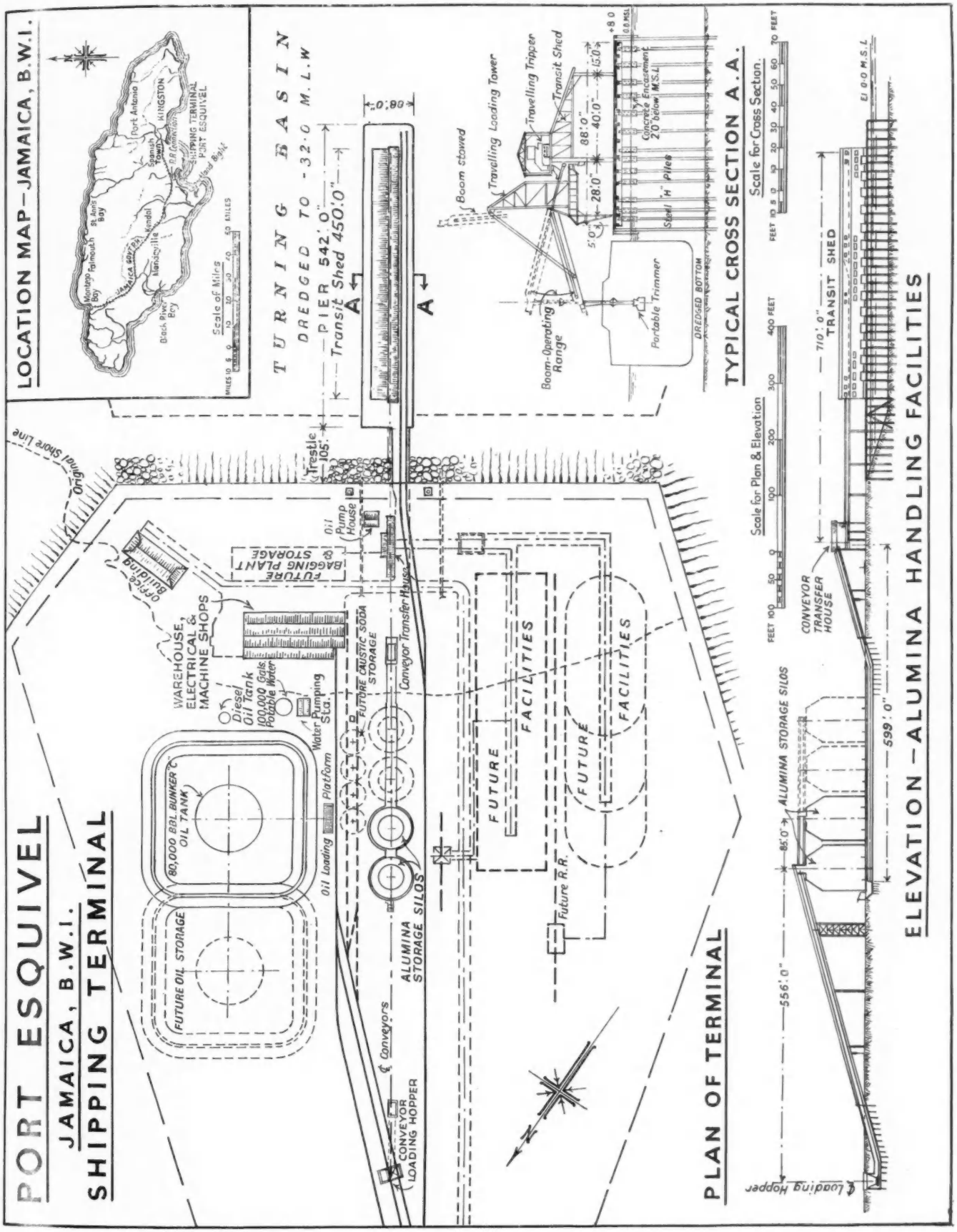
The alumina, upon arrival at Port Esquivel in bottom dump railway hopper cars, is discharged into a receiving hopper under the tracks. From this point the alumina is carried on a 30-in. wide inclined belt conveyor to the top of the two storage silos, into which it discharges through an opening at the top of each silo.

To keep the alumina free flowing and to protect it from loss by wind or increase in weight by moisture, all of the conveyors are housed in fully covered galleries and all transfer points are protected from the elements.

Alumina is discharged from the storage silos to the reclaiming belt conveyor by means of gates in the bottom of each silo. There are three of these gates of special design for each silo, and the number of gates in use and their discharge may be varied to maintain the required constant and even flow of material. The reclaiming conveyor in one continuous belt, 48-in. wide, runs horizontally in the tunnel for the initial and future silos, then inclined upward to a transfer house. A horizontal distributing conveyor extends from the transfer house to the outshore end of the Transit Shed. This conveyor is provided with a travelling tripper with electric motor drive. On this conveyor also there is a recording weighing apparatus located near the tail end at the transfer house. This is the longest conveyor in the installation, being about 710 feet c. to c. of end pulleys. Travel distance of the tripper is 420 feet.

A travelling loading tower provided with a belt conveyor on a hinged boom, receives the alumina from the distributing conveyor and discharges it into the ships' hold. To




PORT ESQUIVEL
JAMAICA, B.W.I.
SHIPPING TERMINAL
PLAN OF TERMINAL
ELEVATION—ALUMINA HANDLING FACILITIES
LOCATION MAP—JAMAICA, B.W.I.
TURNING BASIN
DREDGED TO -32·0 M.L.W
PIER 542'0"
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Scale for Cross Section.
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Trestle 105'
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Water Pumping Sta.
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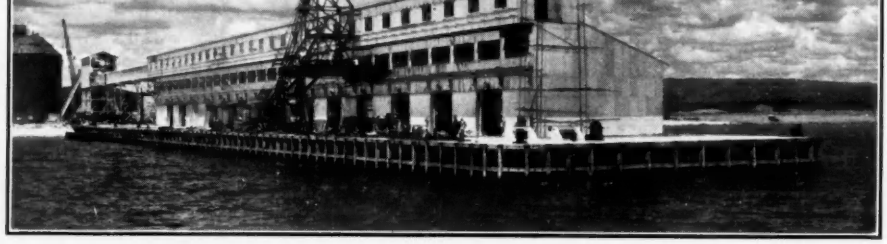
710'0"
85'0"
Loading Hopper

Port Esquivel, Jamaica, B.W.I.—continued



View of Pier. Erection of Loading Tower in progress October 1953.

conserve pier deck space this loading tower has a semi-portal gantry frame with the outer leg rail on the pier deck and the inner leg rail mounted on the face of the transit shed. Inclination of the boom conveyor is adjustable to 15 degrees above or below the horizontal when operating, and may be raised and locked in a vertical position when not in use. The boom conveyor discharges into a drop chute which extends down into the ships' hold. A centrifugal ship trimmer with a rotating adjustment, attached to the lower end of the drop chute, permits uniform loading throughout the hold space. Operation of the trimmer is controlled from the ship's deck. Electric motor drives are provided for all operations including the belt conveyor, boom hoist, trimmer, and for the travel of the tower.

Fuel Oil System.

Bunker "C" fuel oil is delivered by oil tanker ships which call regularly at Port Esquivel. A tanker normally will dock on the east side of the pier and make connection by 6-in. or 8-in. oil hose to a pipeline on the pier. The tanker pumps the fuel oil through this line to an 80,000 bbl. storage tank on shore. From here the oil is transported in railroad tank cars to secondary storage tanks at Kendal for the electric generator station and for kiln firing at the alumina process plant. Ships may also be bunkered at Port Esquivel, the shore pumps providing 1,000 bbl/hour bunkering rate.

Service Building.

Combined under one roof, facilities are provided for the general terminal maintenance and operating services, consisting of: warehouse space, machine shop, electrical shop, and a stand-by electric power plant. The latter consists of one 125 KW capacity Diesel generator which will provide sufficient power for essential services in event of failure of the incoming power lines, which may be expected from time to time due to tropical storms or the seasonal hurricane disturbances. This building is 180 feet long by 80 feet wide, constructed of structural steel framing, corrugated aluminium roofing and siding, aluminium sash, and with precast concrete pile foundations and concrete floors on ground.

Office Building.

This building is essentially a duplicate of the office building in the Bauxite Transfer Station at Chaguaramas Bay, Trinidad, B.W.I. This older building, which was designed and constructed by Frederick Snare Corporation in 1941 for the Aluminium Company of Canada, proved so satisfactory for tropical weather conditions, that it was specified by the owner for the Port Esquivel project. Office space is provided for the shipping terminal manager and his staff, including a lunch room. In this building offices are also provided for government officials having to do with customs and port activities.

This building is 103 feet long by 40 feet wide with the floor line at a raised elevation of 10 feet above the ground. The foundations consist of a series of precast concrete piles which extend above grade 8 feet and connected at the tops by concrete struts to form a rigid frame construction. A maximum of unobstructed space is thus provided under the building for use as garage space, storage space, etc. The building structure is of wood frame construction with corrugated aluminium roofing and siding. Windows are jalousie type, with screens, of Western Red Cedar or Redwood. All framing lumber, sub-sheathing and sub-flooring is pressure treated using chromated zinc chloride preservative. The roof has a wide overhang of 7 feet along each side of the building and is extended to provide cover over a screened veranda at each end.

Molasses Handling.

Subsequent to the construction of the shipping terminal for its primary function of handling alumina, additional facilities have been provided for the export shipment of molasses. Two storage tanks were installed to receive deliveries of the molasses which is transported in tank trucks from the sugar mills to the port. From the tanks the molasses is pumped through 1,000 feet of 16-in. pipe on land and 400 feet of 14-in. pipe on the pier, terminating in hose connections underdeck at hatches on both sides of the pier.

Construction

Dredging.

The first construction operation to get under way was the dredging and the hydraulic fill. Contract for this work was awarded to the Standard Dredging Corporation, of New York, on the basis of competitive bids. Actual dredging work was started February 26, 1952 and was completed October 7, 1952. The total pay quantity dredged was about 3,257,000 cu. yd. Of this total, about 2,246,000 cu. yd. were deposited in the specified shipping terminal area and on low land adjacent thereto. The balance of 1,011,000 cu. yd. was placed in a series of "finger" fills below sea level, extending 1,500 to 1,800 feet in length at right angles to and west of the entrance channel. The shore currents are from east to west and no measurable

Loading Tower handling bulk alumina into ship.

Port Esquivel, Jamaica, B.W.I.—continued

shoaling of either the entrance channel or the turning basin has taken place since the dredging was completed. The material was reported to consist of approximately 73% clay, 11% sand, and smaller percentages of shells, gravel, mud and rock.

The dredging work was done by the dredge " Orleans " which was towed from Tampa, Florida, U.S.A. to Jamaica for this this job. The " Orleans " is a 27-in. hydraulic cutterhead dredge, with a 3,000 h.p. turbine on the main pump and a 650 h.p. motor on the cutter. Power for the latter motor and the other dredge auxiliaries was furnished by an 800 KW turbo-generator. The hull is of steel, 170 feet long by 39 feet wide and 12 feet deep, with wooden house for the engine room and crew quarters. Capacity of this dredge is from an economical minimum of 100 cu. yd. per hour of rock, up to 5,000 cu. yd. per hour of silt pumped through lines up to 10,000 feet long, the output diminishing as the length of discharge pipe increases.

Inspection of the dredging work was carried out by Hattum en Blankenvoort of Amsterdam, Holland, under a sub-contract to Marples, Ridgway and Partners.

General Construction.

The contract for the general construction of the shipping terminal was awarded to Marples, Ridgway and Partners, of London. Their construction supervisory personnel and equipment from England began arriving in Jamaica in January 1952 and the first construction was started in March 1952. At the peak of the construction activity, the construction personnel consisted of about 490 Jamaicans and about 50 others, mostly specialists and supervisory staff from England. Construction of the project was essentially completed by January 15, 1954, on which date the Marples, Ridgway's contract was terminated. Some clean-up operations were continued for a few weeks after this date, this work bing carried out by Alumina Jamaica Limited.

It may be of interest to note that the materials and equipment used in the construction of the shipping terminal were obtained from several countries on both sides of the Atlantic, as follows :

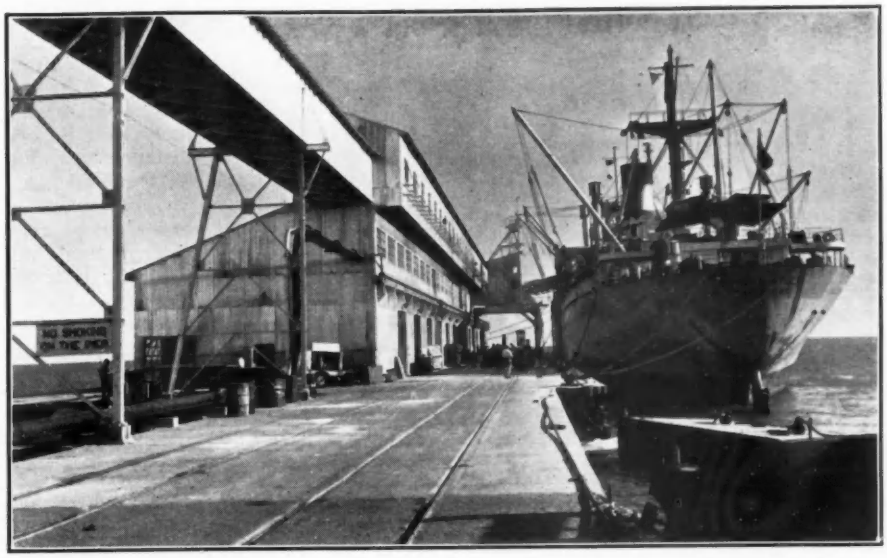
From Great Britain : Structural Steel, Alumina Silos, Oil and Water Storage Tanks, Wharf and Silo Piling, Building Roofing and Cladding, Rolling Steel Shutter Doors, Aluminium Wire Fence Mesh and Posts, Welding Machines, Air Compressors, Electric Motors, Electrical Equipment, Cargo Hose, Oil Pumps, Water Treatment Equipment, Conveyor Belting.

From Canada: Miscellaneous Steel, Building Materials, Pipe and Fittings, Valves, Machine Shop Equipment, Form Lumber, Transmission Line Materials, Conveyor System including Ship Loading Tower.

Locally from Jamaica Cement, Form Lumber.

From United States : Form Lumber, Pipe and Fittings, Sheeting Fasteners, Machine Shop Equipment, Electrical Equipment, Deepwell Pumps, Continuous Conveyor Weigher, Dump Trucks, Fork Lift Trucks, Diesel Locomotive, Used Tank Cars.

From Belgium : Oil Tank Cars, Aluminium Hopper Cars for Alumina Service.



Ship loading at completed Pier. Note the overhanging Conveyor Gallery.

General

The first vessel taking on alumina at Port Esquivel was the ss. " Sunrell " which loaded bagged alumina in June 1953. Bulk alumina was loaded for the first time in January 1954 when the " Sun Karen" took on alumina and 3,800 tons of bagged alumina. The first all bulk shipment was also made on the ss. "Sun Karen." This consisted of 10,439 tons and she sailed on April 5, 1954.

At present production levels the annual tonnage of alumina which will be handled by the Port is approximately 162,000 metre tons per year. This will rise to approximately 210,000 metre tons per year early in 1955. This by no means represents the capacity of the Port which, with additional bunker capacity, could be in the neighbourhood of 1,000,000 metric tons per year. While much of the production of Alumina Jamaica, Ltd. will be required to supply the smelters at Kitimat, B.C., other alumina shipments to Scandinavia have already been made and will be continued.

Of secondary technical interest is the export shipment of molasses which is produced by the sugar mills in the vicinity of Port Esquivel. These shipments are expected to total 44,000 tons annually.

The majority of imported cargo now being handled is for maintenance and supply of the alumina plant at Kendal. Such imports are heavy oil fuel and soda ash. At the present operating level the fuel and diesel oil imports run to approximately 500,000 barrels per year, and soda ash to approximately 50,000 tons per year. Such imports would increase proportionately with the export of alumina as plant capacities are expanded.

All alumina so far carried from Port Esquivel has been by means of standard ships with suitable alterations to permit the safe carriage of free-flowing bulk cargo. The modifications consist of longitudinal and transverse bulkheads to prevent shifting. One special ore carrier, the ss. " Sunrip," will undoubtedly shortly go on this service. It is 450 feet long by 62-ft. 6-in. beam, having a total deadweight of 12,670 tons on a draft of 29-ft. The special features are that she has a steel centre line bulkhead in all of the lower holds to prevent possible shifting of cargo. Twin cargo hatches admit to each hold. Hatches of 18-ft. 6-in. width allow good digging area for grabs. The hatch covers on the second deck hatches are hinged to open up and when carrying bulk cargo, the covers may be opened and fastened to form a feed trunk to the lower holds.

The planning, engineering and construction of this project was carried out under the direction of the organizations and their principals, as follows :

Aluminium Laboratories Limited, Montreal, on behalf of: Alumina Jamaica Limited, Jamaica, B.W.I. ; Mr. N. P. Taylor, Vice-President and Chief Engineer; Mr. D. G. Elliot, Chief Draftsman ; Mr. P. Fraser Bell, Project Manager ; Mr. T. H. Henry, Resident Engineer.

Frederick Snare Corporation, New York, Engineers and Contractors; Mr. L. E. Stephenson, Vice-President ; Mr. A. D. Quinn, Chief Engineer.

Standard Dredging Corporation, New York, Dredging Contractors ; Mr. Rowan Cummins, First Vice-President ; Mr. J. B. Murray ,General Superintendent.

Marples, Ridgway and Partners, London, General Contractors ; Mr. R. J. Ridgway, Managing Director ; Mr. L. V. Harrison, Agent.

Historical and other Trends affecting the Function of a Port

Trade at the Port of Bordeaux

It may fairly be said that the present day activities of a port, as shown in the annual returns, are no more than an instantaneous photograph so to speak, taken at a moment in time between the past and the future. The activities reflected in such a photograph have their origins in historical and economic trends which spread far beyond the port and its hinterland, sometimes to the farthest corners of the world. It is seldom that a close analysis is made of the functions of a port, and of the trends which contribute to its present status, nor is it often possible to deduce in what direction the port should seek to expand its trade in order to prosper. Recently, however, a study* has been made of the varying fortunes and possible future of the port of Bordeaux; it was undertaken under the joint auspices of Rutgers University and the American Office of Naval Research.

While space does not permit of an extended resumé, it is thought that the conclusions and predictions of the author will be of interest:

"The primary function of the port of Bordeaux is to handle goods, that is to transfer them from vessel to land and vice versa. All other functions are subordinate. Secondary functions have been variously classified: by type of ship using the port (tramp, liner, tanker), by nature of merchandise carried (for example, coal, petroleum, fish), by what happens to the cargo in the port (industrial, commercial, transit, transshipment), or, finally, by the extent of the port hinterland and foreland (local, regional, colonial, national, international). None of these classifications is satisfactory in itself. Thus Bordeaux partakes, or has partaken, of all the functions mentioned. How well the port performs its functions at any one time depends on a multitude of factors.

"In the broadest sense it depends on the world patterns of human activity at any one period and the relationship of site and situation to a given set of conditions. The New World had not been discovered when the port of Bordeaux was enjoying its flourishing period of close connections with England. No one could have foreseen then that the port would become one of the important gateways to and from the West Indies, or that the agricultural hinterland which had given the port and city their splendor would later be a serious handicap. In the eighteenth century it was inconceivable that this gateway would ever be marginal to the world's great sea routes, or that French colonial development in Africa would re-create Bordeaux to some extent as a colonial port. Neither hinterland nor foreland nor the port itself alone has determined its destiny; rather, the totality of expansion and development in the world at each stage has narrowed or broadened its field of economic activity.

"In a narrower sense economic and political necessities of France as a state have influenced ocean trade on a broad scale. Government policy has had a powerful influence on the changing traffic patterns, as is evidenced in Bordeaux by the movements of coal, sulphur, and wheat. These products are under government control from the time they are purchased until they are sold, and the middlemen, including the manufacturers, have no choice but to accept what is prescribed. The flow of traffic frequently does not follow the routes one would expect if merchants and manufacturers could operate under free competition. Moreover, since World War II the state has competed with private shipping by offering special rates on the State Railroad for destinations within France. This policy has greatly reduced coastwise shipping, and thereby port traffic. On the other hand, the accelerated development of Africa, at closest range to Bordeaux, has emphasised a new direction in the traffic flow of the port. The Bordeaux efforts have not yet been as fruitful as those of Marseilles, which as a result of French policy has succeeded in integrating Algerian traffic with its own. Then, too, the national policy of using home products in preference to imported ones to save foreign exchange has reduced imports without compensating for the loss by an equivalent increase in exports.

"Finally, there are factors within the port itself that guide its functions and their changes. The Bordelais themselves have never taken part in shipping. The reason cited most often its that they have never been 'sea-minded,' being settled a relatively long distance from the ocean. There is no denying that Basques, Normans, Bretons, and others usually made up the complement of seamen, or that only one out of 34 French companies using the port has its home office in Bordeaux. Extreme caution and conservatism are apparent even now when aggressive and daring action by the port authority and commercial interests is needed to revive the port and make the best of its advantageous location with respect to North and West Africa. Already the port has lost a percentage of the banana imports to Nantes because of lack of specialized equipment, and it is currently in danger of losing part of its fresh vegetable imports from Morocco for the same reason. La Rochelle-La Pallice, on the other hand, which is keen to expand its traffic, is about to complete a cold-storage warehouse within the port for such imports.

"Industrialization came late to Bordeaux and has not been extensive, in part because the southwest has neither fuel nor raw materials. Local fuel resources have now been developed in the form of natural gas, hydroelectric power, and petroleum products, but the hinterland is still largely rural, providing only a meagre market and source of merchandise for export. Bordeaux has counted too heavily on the continuance of exports of wine and forest products, which proved to be unstable commodities over the years, whereas Nantes, despite its agricultural hinterland, organized industries earlier.

"The physical setting of the port of Bordeaux, once an asset, is now a handicap. The days have long since passed when an inland location was desirable for the protected anchorage of sailing vessels. Today larger ships can enter and leave the main port at high tide only. Three berths can accommodate ships drawing 29.5-ft. as a maximum without touching bottom at low tide; at the oil outport of Pauillac the limit is about 33-ft. The need for providing accommodations for larger ships was recognized after World War 1, and an outport, Le Verdon, was constructed near the mouth of the estuary and put into operation in 1933. There fast ships with still deeper draft could call, discharge, and take on passengers and special consignments. The Germans demolished these facilities, and reconstruction has not been considered because of the expense and because of the strong currents. The mandatory use of two pilots between Bordeaux and the mouth of the estuary substantially raises the cost for the shipping line. With operating costs mounting steadily, shippers are anxious to anchor with as little delay as possible and effect a rapid turnaround. Canalizing and deepening the channel would, of course, improve physical conditions, if the resulting increase in traffic would justify the expense.

"Bordeaux, not being located on a major ocean seaway and having no hinterland that in itself can stimulate ocean trade, must capitalize on its location in relation to Africa. The present underdevelopment of Northwest and West Africa present Bordeaux with a unique chance to strengthen its somewhat limited commercial and manufacturing functions. This might be achieved by increasing its stature as an important centre for French Union products from Africa and by specializing in manufactured articles needed in Africa. Such a programme would assure two-way traffic, which, with the increased development of colonial territories, would stimulate growth of the regional economy in the southwest."

* Weigend, Guido G., "Bordeaux: an example of changing port functions." Geographical Review, April 1955, New York, pp 217-243.

Reducing the Noise of Pile Driving.

It was recently announced that Sir Robert McAlpine & Sons, building contractors, are experimenting with two new methods for reducing the noise of pile driving. The tests are being carried out in the laboratories of the Company and research on the techniques is being pressed forward.

Of the two experiments in progress, one involves the use of a plastic pad placed between the hammer and the pile head. The other, which has only before been tried on a small scale, involves the use of hoods designed to fit over the hammer to reduce the noise of the hammer striking the pile.

Shipping in Port

Organisation Needed for Quick Turn Round

Planned to be held at Southport early in June last, the Annual Congress of the Institute of Transport was unfortunately cancelled owing to unforseen travelling difficulties. Among the papers which were to have been presented at the Congress was one entitled as above. The authors were Mr. F. H. Cave, M.Inst.T., general manager and secretary, Mersey Docks and Harbour Board, and Mr. F. H. Dawson, C.B.E., M.C., M.Inst.T., director and general manager of the Cunard Steam-Ship Co., Ltd. The object of the paper was to present a joint picture of port working from the viewpoint of a port authority and a shipping company.

The paper was printed in the July, 1955, issue of the Journal of the Institute of Transport and in order that it should be disseminated as widely as possible, it is being reproduced in this Journal by arrangement with the Institute.

IN 1938 there was published a unique world map showing the positions on a given day of 2,476 British ships of 3,000 tons gross and over; their positions defined the world's trade routes and their concentration or density the relative importance of each seaway. These ships were heading towards hundreds of ports; each day as they entered those ports there was put in motion the complicated chain of events which was only complete when the ships set out on other ventures, taking the places at sea of ships at that moment putting into ports on the other side of the world.

The ships are the conveyors of commerce, the ports are the clearing houses in the vast and continually changing pattern of world trade. Within this combination the workings of an individual shipping company and an individual port authority can be broken down into a series of smaller patterns represented by the activities necessary for each voyage, itself a separate venture, and by each branch of port administration. Thus, the ship, if she is a liner on a regular berth, fits into the pattern of a sailing schedule planned months in advance. There will be the widespread pattern of activity on the part of the shipping company and its agents seeking business for the advertised sailing of the ship. In the port there will be the pattern of disposal of import cargoes or of assembly of cargoes for shipment—the raw materials of industry and the finished products from an industrial hinterland. Whatever is converging on the port will depend for its volume in large measure on the success of individual industries in highly competitive international markets—and on their success will depend the economic health of the shipping company, of the port through which the goods will pass and of the nations which send or receive the cargoes. Stated in the most elementary terms, the ships cannot do without the ports, the ports cannot do without the ships and a nation such as Britain cannot do without either.

This paper aims at presenting a joint picture from the viewpoint of shipping company and port authority whose activities combine in the task of making a ship ready for sea again. She is but one ship among many; her owners but one company in one trade. With her in port are a great many other ships of all types, all of them making varying demands on the facilities of the port according to their degrees of complexity as types of ship and cargo. It is the overall jigsaw pattern produced by all of these with which we propose to deal. The degree of perfection of this pattern, and the efficiency of its organisation, control in turn the time in which all the necessary services can be performed, which is generally called the " turn-round " of the ship.

A few figures will put into perspective the significance of one ship's turn-round. At British ports last year over 91 million tons of cargo were discharged, and 38 million tons loaded outward. The net tonnage of foreign-going ships entering and clearing United Kingdom ports with cargo in 1954 was 123 million—and 73 million tons of this total was British owned. Putting it another way, each day there was an average of no less than 125 arrivals and 111 departures with cargo in the ports of this one island, while the average for coastal vessels was an additional 230 entrances and 232 clearances. The figures strikingly reveal a tremendous scale of movement, and it is obvious that there must exist an intricately dovetailed number of business organisations specialising in this work, upon whose efficiency depend the coming and goings of the ships. Their importance may be gauged by the fact that, excluding London, some 12 per cent. of the working population are employed at United Kingdom ports.

Organisation of Port Authorities.

These ports are places which have been approved as such by Her Majesty's Commissioners of Customs and Excise and whose limits have been defined by the Crown. They vary in size from the small quays at Wigtown and Aberystwyth to the miles of wharves and docks at London and Liverpool. Their constitutions also vary to a very wide extent, for they may be controlled either by the State, a local authority or a public trust. A few in fact, such as Bromborough on the Mersey, are privately owned. Most of those controlled by the State (the British Transport Commission), such as Newport, Swansea, Cardiff, Hull, Garston, etc. were originally built by the various railway companies, not as separate units, but as feeders of the railway systems. Bristol and Preston are the principal ports which are municipally owned and four great ports, London, Liverpool, Glasgow and Belfast are controlled by statutory public trusts. This latter type of constitution has much to be said in its favour, for it is based on the principle that ports should be owned and controlled by those who use them and that there should be a continuity of policy free from political influences.

There is very great divergence in the scope of ownership and control by port authorities. Liverpool provides an example in which the control of all major functions is in the hands of the authority which, besides owning and controlling all the docks of the port, is also responsible for all pilotage, salvage, lighting, buoying and conservancy of the port and its approaches. In London, the authority owns and controls all the port's dock systems, but there is a very large number of wharves up and down the river which are owned by private companies. In London also, as in many other ports, the pilotage services are provided by Trinity House which also has an overriding authority over lighting and buoying. The duty of handling cargo and performing various other services also varies widely between ports, from the extreme examples of Manchester where the Ship Canal Company have the exclusive rights of loading and discharging, to Liverpool where this is not done by the port authority but by master porters and master stevedores, many of whom, in practice, are directly associated with the shipping companies and whose work is subject only to the bye-laws and regulations of the authority.

It must not be imagined that this lack of standardisation is a sign of inefficient organisation as between port and port, for the particular system which is followed at each port is largely based on the tradition and development of the individual ports which range from those which were famous in Roman days to those modern ports which are products of the Industrial Revolution of the nineteenth and twentieth centuries.

Functions of a Port.

It is the duty of a port to make provision for ships and their cargo. In the broadest terms they must, therefore, provide facilities which will ensure:

(a) The safe arrival, harbourage and departure of ships as well as their repairs, bunkering and servicing whilst in port; and
(b) The efficient discharging and loading of goods and passengers with ample and economical facilities for their distribution to or arrival from the hinterland.

Within the scope of these general terms lies the whole relationship between the port authority and the ship but the angle of approach to the subject differs essentially between the two organisations. It must always be remembered that a ship fulfils her main function whilst at sea and from the shipowners' point of view the less time that is occupied by operations in port the greater will be her earning power. It is for this reason that such great empha-

Shipping in Port—continued

sis is placed, especially at the present time, on the speedy turn-round of a ship and whilst there may be no such urgency from the point of view of the economic working of the port as such, it is the port's duty to see that all the necessary facilities are available which ensure that the ship will be able to spend the maximum possible time at sea. The administrators of a port are faced with many new problems created by this demand for speed and a new comprehension of port services has had to be developed. In general terms it is immaterial whether these facilities are provided by the port authorities, a public corporation such as Trinity House or by private enterprise. From the point of view of both ship and cargo, the essence is that ample and efficient services should be available at the lowest economic cost.

Mention has already been made of the variation as between port and port in the provision of major services for the navigation of the ship, such as pilotage and conservancy, and similar considerations apply to the provision of many other needs of the ship and cargo which will be dealt with in some detail later in this paper. It is, for example, usual for ship repairs to be undertaken by private firms who specialise in that business and the dry docks which are used in connection with these repairs may equally well be owned by the port authority or the ship-repairing contractors. It is the usual, though not the invariable practice in ports of this country, that towage is performed by privately owned tugs, whilst the facilities for bunkering vessels, which in the days of coal bunkering were sometimes provided by the port authority, have with the advent of oil burning ships largely passed into the hands of the oil companies.

The provision of fixed and heavy cranes is generally considered to be the responsibility of the port authority but mobile mechanical equipment is largely owned by the operators when stevedoring is done by shipping companies or private firms.

The provision of warehouses may equally well be undertaken by the port authority or private enterprise and there is not even a general practice with regard to the policing of the docks, which may be done either by the private force of the authority or by the local Watch Committee. There is in fact little or no uniformity in our ports with regard to the provision of the essential port services, which are so necessary for the proper functioning of the port.

Requirements of Shipping.

The first requirements of a ship approaching a port is a sufficient depth of water in the channels to enable her to enter without undue delay. This entails in some cases, the maintenance of large and costly dredging organisations, the construction of revetments and training banks and periodical surveys. The channels must be equipped with efficient buoys and lights to enable the ship to enter the harbour safely and salvage assistance must be readily available in case of necessity. She must have the assistance of a qualified pilot and a fleet of pilot boats must be maintained for this purpose. In ports where the rise and fall of tide makes berthing at tidal piers or wharves impossible, the ship requires an enclosed dock entered by means of deep water locks to minimise delays in getting to her discharging berth. The association of ship and port arises from two factors. So far as the port is concerned it must be provided with the natural advantages of good access and a safe harbourage whilst as a cargo or passenger carrier a shipowner is interested in the proximity of the port to the great centres of industry and population. It was inevitable that during the industrial revolution ports and ships developed in conjunction one with the other to serve the needs of the industry and population of the hinterland until today the requirements of shipping in a port have so increased in complexity that it will be well to examine them in considerable detail.

In order to make this survey as comprehensive as possible it is proposed to consider the requirements of a passenger/cargo liner in order that attention may be drawn to the needs of both sides of the revenue earning work of mercantile fleets. It is assumed that that ship is being turned round in her home port and, because of that, she will be dealt with by the shipping company's own departmental organisation rather than by agents who would be responsible in other ports.

In the case of a regular user of the port, the procedure follows a well defined pattern. The Master knows how far ahead to signal the expected time of arrival and is fully aware of the formalities with which he is expected to comply. The Pilot assigned to meet the ship at the harbour limits is specially allocated for the pilotage of the company's ships and familar with their characteristics. The crew, too, are familiar with the preparations necessary for the discharge of the passengers and cargo. The ship will be met by members of the company's technical staff who are fully conversant with the nature of the tasks to be carried out when they go aboard. The ship's discharging berth will be one regularly occupied by the company's ships and the company may also employ its own wharf and stevedore staff who will be responsible for the loading and discharging operations which they have carried out many times previously. Before the ship's arrival the shipping company's Freight Manager and Superintendent Wharfinger will have considered the stowage plan received from the port of departure, detailing the location of the cargo stowed. So too the Government and port officials who require to have contact with the ship—Public Health, Customs and Immigration—will generally have had prior experience of dealing with her on previous calls. Thus there is in being a pattern of operation whose repetition makes for smooth and efficient working.

If the ship carries more than the twelve passengers which are normal in a cargo liner, she will probably disembark them at a special terminal before proceeding to her berth for the discharge of her cargo. For both these operations she will require the services of tugs and will be boarded as soon as practicable by officials from the Government departments and the owner.

Included among these would be the Port Medical Officer, who must satisfy himself that the ship has a clean bill of health before anyone is permitted to disembark. H.M. Customs officers would also board the ship and examine her documents, seal all spaces containing dutiable stores and search the ship for any contraband. It is their duty to examine the personal baggage of any passengers or members of the crew who may be landing, and collect such duty or purchase tax as may be chargeable. At the same time H.M. Immigration officials would be in attendance to examine the documents of all passengers landing, to ensure that the Immigration Regulations are complied with. In addition, C.I.D. officials frequently board passenger ships and scrutinise the manifest of passengers for undesirable persons, as well as investigating any criminal activities that may have taken place on board during the voyage. Close liaison must be maintained with all these officials while they are carrying out their duties.

It is necessary for the ship to be properly " entered " at the Customs House, and at the first opportunity the Master, in person, must report the arrival of the ship at the House. It is also cusomary for the Master to " note protest " against the wind and weather experienced on the voyage before a Commissioner of Oaths.

There is constant emphasis today on the importance to Britain of the tourist trade as a major contributor to the national income and, as first impressions count for so much, it is in the interests of both the Port Authority and shipping company that facilities for the reception of passengers should be above reproach. The number of ports on our coastline regularly handling passengers from overseas are relatively few and nearly three million visitors pass through them annually.

The ports have been alive to the necessity of keeping abreast with the times in the type of facilities offered. At Southampton for example, an ocean terminal has been built lavishly equipped with modern aids for the handling of passengers' baggage to and from the Customs examinations, whilst the passengers themselves have at their disposal the entire upper floor where rest rooms, money exchange booths, refreshment bars and the offices of travel agents and cable companies are provided. From such a reception point passengers pass to and from boat trains which draw up inside the terminal itself. At Liverpool, there is the Princes Landing Stage alongside which ships can berth at all stages of the tide, the stage being a floating wharf connected by gangways to the Customs examination rooms, roads and a railway station. The purpose of these terminals is to provide rapid undercover transit between the ship and shore transport for both passengers and baggage, and they could not have been created without the closest co-operation between the passenger liner companies and the port authorities.

Shipping in Port—continued

Once passengers have disembarked the ship immediately comes into line with the general run of cargo ships and the problems of discharge are common to both. The company's technical officials are in consultation with the ship's officers to see what work may be required in the ship before her departure. This is based on reports, submitted immediately she arrives, covering victualling, deck or engine stores and repairs. These may not exceed running repairs which can be dealt with on the berth by the ship repairers appointed to carry out the work, but it may be that heavy weather damage or a major defect necessitate the use of a dry dock where there are cranes capable of handling heavy machinery parts and hull plates and frames. Such damage must be inspected by Lloyd's and Ministry of Transport and Civil Aviation surveyors and representatives of the owners. A Certificate of Seaworthiness will not be granted until the requirements of the surveying authorities have been met. The periodic need for such major repair work to a ship's hull or machinery demonstrates how important it is that there should be specialised firms in the port capable of carrying out this work at short notice. Apart, however, from the question of damage, the owner is required to put his ship in dry dock to undergo survey annually in accordance with the rules laid down by Lloyd's and the Ministry of Transport and Civil Aviation whose officials make a rigorous survey from truck to keel.

Voyage repairs are services for which shipping companies can rightly expect to find facilities readily available in a port, but the provision of accommodation for major repairs and long term overhauls frequently produces a considerable problem for the port authority, particularly when large passenger ships in the same trade wish to be accommodated in the short period of their "off" season. The problem arises mainly through the fact that as a rule dry dock accommodation is required for only a minor part of the overhaul and wet dock berths must be provided for the remaining period. In the majority of our great ports the quays of the wet docks are equipped with transit sheds for cargo handling and when a port is busy it is impossible to spare one of these berths for a lengthy period without causing delay to other ships which require it for dealing with their cargo. The position was particularly acute in the years immediately following the war when a tremendous volume of repairs and re-conversion was taking place, but today demands for ship repair berths have decreased and it is only on exceptional occasions that shipping companies find it necessary to send one of their ships to a shipyard or port other than the ship's base port.

Included in the ship's requisition will be one for bunkers. The number of coal burning ships is dwindling and ships are now usually bunkered at their berth by pipeline from oil barge or small tanker instead of moving to a coal tip to take fuel. Bunkering of oil implies a simple operation but it is not merely a question of pumping oil into any tanks that happen to be empty or partially filled. Normally, oil separators in the ship are used, but frequently more extensive tank cleaning may be necessary, which necessitates the calling in of yet another specialist organisation, one usually operated by a ship-repairing concern who bring a tank cleaning vessel alongside the ship. In addition to bunkering a full supply of fresh water must be pumped into the tanks already cleaned out to receive it. Whilst attention is being given to the efficient maintenance of hull and machinery, orders are sent out to yet another group of specialised firms which have grown up in the port as grocers and provision merchants on the same scale as that of the ship chandlers, the bunkering services of the oil companies and the suppliers of deck and engine stores of all kinds. Several tons of foodstuffs, a like amount of paint, vanloads of linen fresh from the laundry, an oil barge with a thousand tons of fuel and messengers bringing the smaller items such as fresh plants and flowers, may well converge upon the ship on one day.

The layman scanning the deck of a ship in port may well imagine that it will be a long time before she puts to sea again. All the hatch covers are off; all holds are being worked as a miscellaneous export cargo comes up over the sides in slings; there is constant movement as derrick booms and crane jibs swing back and forth whilst blocks, ropes and tackle litter the decks making walking a precarious operation. Overside, riveters may be replacing a plate which has been straightened and faired ashore, whilst on the boat deck caulkers are going over the deck seams. In the public rooms, state rooms and still further down in the engine room, skilled hands are engaged on the task of preparing the ship for sea.

The crew must be signed on. It is axiomatic that the efficiency of a ship depends upon her officers and crew. Many make their careers with one company and not infrequently ratings remain in one ship for considerable periods, proving that they are contented, which helps to make for a happy and efficient ship. Nevertheless, a number of crew changes take place each voyage and replacements are obtained through the medium of the Merchant Navy Established Service Scheme, an organisation operated by owners throughout the indutry and designed to provide continuous employment for seamen. Although their employment on articles is laid down by statute under the Merchant Shipping Act, their pay and conditions are broadly determined by the National Maritime Board, an organisation composed of representatives of shipowners and the officers' and mens' societies or unions, which can claim a proud record of harmonious relations within the industry since the establishment of the Board in 1919.

Requirements of Cargo.

Previous sections of this paper have dealt with the requirements of the ship from the viewpoint of maintenance and operation as an efficient unit for conveyance of goods and passengers. It is now necessary to consider the provision of facilities for the efficient loading and discharging of goods, which takes place simultaneously with the operations of the last section. In the first place, the quay alongside which the ship berths must be equipped with either transit sheds for the reception of general cargo or with specialised equipment for the handling of such cargoes as grain, ores and sugar. It is the usual practice in this and other countries to equip the quay with discharging and loading cranes suitable for the type of cargo to be handled and to make available floating cranes for dealing with heavy lifts beyond the capacity of the ship's derricks or quay cranes. There is no standard type of transit shed but all port authorities agree that they must have sufficient floor space and height to enable the various operations to be carried out; they must be sufficiently secure to satisfy the customs authorities; and they must be structurally sound to prevent damage to the cargo by the weather. Ample railway and road facilities must be provided and there should be sufficient warehouse accommodation of both specialised and general types to receive cargo which requires this facility.

Very few ports meet all these requirements in the highst degree as they have developed over many years and whole dock systems cannot be rejuvenated overnight. A great deal of structural work is being undertaken in most of the ports in this country and, generally speaking, the equipment of all our ports can bear comparison with that provided at overseas ports. New quays are being built with aprons wide enough to take a double railway track so that if need be ships can discharge directly overside into trucks, thus relieving congestion in the sheds. Modern design provides greater freedom for the operation of cranes and other mechanised aids to cargo such as conveyor belts, fork lift trucks and power driven bogies.

The problems arising from the reception and distribution of inward cargo and the assembly and loading of outward cargo vary from port to port but essentially the requirements are the same.

A port has to deal with many ships, including those making but an occasional call. It may be that the port will be called upon to deal with any one of several different ship types, such as a fruit carrier, a timber ship with a bulky deck cargo, an ore carrier, or a heavy lift ship fitted with gear to lift 150-ton locomotives and even small tugs. Whatever the ship type, there will be special problems attached to discharge and loading, all of which the well-equipped port will meet efficiently so that owners of such specialised tonnage who are not tied to any one port will be encouraged to return. This applies especially to foreign flag cargo carriers which are to be seen in numbers in many British ports.

If the ship is also carrying dangerous cargo she will require to follow the special procedure laid down for these types of commodities. Moreover she may have a certain amount of cargo for transshipment to other ports, some of which may be discharged overside into barges or direct into the holds of small coasters. If general

Shipping in Port—continued

cargo is unloaded on to the quay and thence into the shed it must be efficiently stacked for speedy clearance to consignees who will have been notified of the arrival of their goods by the shipping company. Whether the cargo is being discharged by the company's own wharfinger staff or by a stevedoring firm, under contract, the company will ensure that watchmen are in attendance in the hatches and various points ashore to guard against pilferage and also report on damage occurring. Any damaged or pilfered cargo must be reported and may be subsequently surveyed by the port authority in view of the necessity of reaching an eventual settlement of the consignees' claim.

The loading of outward cargo begins as soon as the ship has finished discharging and it may require a move to another berth. Thousands of tons of inward cargo will be moving over the country's roads and railways, passing on its way inland, train and lorry loads of exports bound for the port. In the offices of the shipping company there will be nearing completion the work of weeks that has been spread throughout its branch offices and agents up and down the country, who will have been securing passengers and freight for the advertised sailing of the ship. Passengers will be interested solely in the sailing date; to the shipper the closing date is more important, because this is the date by which all cargo must be received on the quay if it is to be in time for shipment by this sailing. Parallel with the loading of cargo, documentation is proceeding in the company's Outward Freight Department as the cargo manifest is prepared and bills of lading endorsed with the rates of freight to be paid, based on measurements checked by the Wharfinger's Department when the goods were delivered on the quay by the shipper.

So far as outward loading is concerned, the efforts of the port authority to provide sufficient accommodation for the assembly of export cargo can be seriously impeded by the practice of those shippers who delay sending their traffic forward in good time before closing day. This results in delays to their road vehicles and places a heavy strain upon those responsible for loading the vessel. In addition to the problems affecting the loading of general cargo, special stowage is arranged for fragile or dangerous cargo by joint action between the company's Outward Freight Department, acting on behalf of the shipper, and the wharfinger at the dock. Here again is demonstrated the great value of the wharfinger's familiarity with the ship through repeated dischargings and loadings of cargo. He and his staff have an intimate knowledge of every nook and cranny in each hold, and can always bring to mind a mental picture of the cargo spaces in the ship, which is of immense practical value when on each successive loading they are confronted with problems of stowage for shipments that range from such things as a 150-ton transformer for a power station or a section of a bridge to small lots of fine goods. The Marine Superintendent will have been consulted in advance should any heavy deck cargo be forthcoming for this sailing. If the ship's itinerary includes one or more discharging ports, the cargo will have to be easily accessible—a requirement so easy to state, but one which nevertheless calls for all the wharfinger's skill and experience.

As loading nears completion the mails and also passengers' cars arrive for shipment and, as each set of hatch covers goes into position and the derricks are stowed, the ship begins to look ready for sea. Prior to sailing the main engines are tried, the steering gear and telegraphs linking bridge and engine room are tested and the ship's company mustered at emergency stations for boat and fire drill. At the same time, shore painters are carrying out a programme of overside and interior painting.

The Master and senior ship's officials having received their instructions for the voyage, and the ship having been cleared "outward" at the Custom House, she again moves alongside the passenger terminal. The shipping company have advised the Customs and Emigration authorities who are in attendance to get passengers on board with the minimum delay and in the maximum comfort.

With the sailing of the ship the processes of turn-round are not entirely complete. There may be cargo still on the quay which has been short-shipped and, in any event, the shed must be cleared and made ready for the next ship on the berth. Further, where short voyages of between two and three weeks are involved, preparations will be in hand for the reception of the ship on her return, when the turn-round cycle will once again be repeated.

Labour Organisation and Industrial Relations.

Enough has been written in this paper concerning the services necessary for the efficient functioning of the port, the ships that use it and the movement of cargo through it to give a broad picture of the multitudinous trades which are practised within the confines of a great port. Quite naturally, however, there are in the public mind two trades which stand out pre-eminently in connection with ports and shipping—those of the seamen and the dockers. With regard to the former, attention has already been drawn to the harmonious relations which have existed within the industry for many years; unfortunately, as is currently very obvious, the same cannot be said of the dock workers.

In view of the vital part which the dock worker plays in relation to shipping in port and the overriding control which his work has in effecting the speedy turn-round of ships, this paper would not be complete without a brief account of the organisation and industrial relations of dock labour. As will be shown, these two sides of the picture are quite distinct and every effort will be made to deal with the matter on a purely factual basis.

In 1946, under the power conferred on him by the Dock Workers (Regulations of Employment) Act, 1946, the Minister of Labour set up a Scheme, the objects of which were to ensure a greater regularity of employment for dock workers and to secure an adequate number of dock workers for the efficient performance of dock work. This in effect continued and enlarged certain war time regulations. The underlying purpose of the war time regulations was to abolish the purely casual nature of dock work, an object which can be amply justified on both social and industrial grounds.

In order to effect this, the Minister set up a National Dock Labour Board consisting of equal numbers of employers' and workpeople's representatives with an independent Chairman appointed by the Minister. Provision was made for certain of the day-to-day functions of the National Board to be delegated to Local Boards in the principal port areas, similarly constituted, but without an independent Chairman.

The first duty of the Board is to provide a sufficient regular labour force of dock workers in each port area which is done by making a Register of the workers with a maximum strength determined by the Board. Operational employers (port authority, shipowners, master stevedores, etc.) are also placed on a Register and only those so registered can employ dock workers whom they requisition from the Board mainly in accordance with their day-to-day requirements. The Scheme provides than the men shall work during the recognised hours and obey the proper orders of their employer and that, if they fail to do so, the employer shall return them to the Board with a report on the subject, and the Board, after the employer and the man have been given an opportunity of stating their case may, if they find that the offence is proved, remove the man from the Scheme or award a lesser penalty. Provision is also made for an independent Tribunal to which the man can appeal against the decision of the Board.

The Scheme also provides that the employer shall pay to the Board the full amount of the earnings of the men supplied to him, together with an additional percentage on those wages to cover the cost of a fall back payment to men who report to the Board for work (as they are obliged to do) but for whom no work is available, for administration expenses of the Scheme and for welfare, etc.

These are the principal features of the Scheme. As the result of experience certain criticisms have been made concerning it and the Minister of Labour has recently announced his intention to make the Scheme the subject of an official enquiry.

The National Dock Labour Board do not concern themselves with industrial relations which are still negotiated between the operative employers and the Trade Unions. The pattern of these provides for joint negotiating bodies on both national and local levels. The machinery is available for the settlement of the many problems which beset so great and important an industry but unfortunately, as is well known, it is at the moment of writing this

Shipping in Port—continued

paper, soured by disagreement between trade unions to which dock workers belong.

Port Finance in relation to Shipping.

Although there are many examples throughout the world of ports which in one way or another are subsidised from public funds, the consensus of opinion in this country is firmly in favour of ports which are self-supporting. In general terms there are three sources of revenue in port operation, viz. direct charges on ships and cargoes which use the port and charges for a wide variety of ancillary services. There is no common pattern of the incidence of each of these charges and for this reason it is almost impossible to make direct comparison of the individual charges made in respect of any one of them as between port and port. Even the total charges made by different ports are difficult of comparison, owing to the varying scope and quality of the services available at each port.

In spite of these difficulties of theoretical or paper assessment of port costs, the comparative value of the use of each port is, of course, well known by experience to both shipowners and traders; and the system of individual instead of national ownership provides a strong and healthy competition among port authorities.

With few exceptions the port authorities of this country are non-profit-making bodies which provide for their capital requirements by the issue of securities bearing fixed rates of interest. The purposes for which they can use their revenues and the maximum limits of the principle charges which they are entitled to levy are in most cases regulated by statutory instruments and when capital has been serviced and administration and maintenance costs have been paid, any surplus revenue must be applied to the benefit of the port by way of decreased charges, redemption of capital or for the provision of new capital undertakings.

With this background and the close co-operation which exists between port authorities and shipowners who make regular use of the port's facilities it is understandable that friction between them on this subject is of rare occurrence.

Conclusion.

In conclusion, the attainment today of a turn-round as rapid in proportion as the passages made by its ships is one of the ideals of every shipping company — setting aside, of course, the ever-pressing problem of tonnage replacement and the need for ceaselessly exhorting successive Chancellors to set free for new tonnage some of the excessive sums which are drained away in taxation. How often since the war has one read of liner companies laying down new ships 2 to 3 knots faster than their predecessors, so that an extra voyage could be worked into the annual schedule of each ship. The theory is sound enough but, in practice, all too often the 17-knot cargo liner, an extremely efficient instrument whose hull, high-powered propelling machinery and complex auxiliaries may well have cost over a million pounds to build, lies in port waiting for a berth, whilst each added day nullifies the advantage gained by her fast passage. When she is brought alongside, the excessive time and cost expended in discharge and loading further diminishes the shipping company's profit margin.

It is in the interests of both port authority and shipowners that ships should be discharged and loaded as quickly as possible. The revenue they earn is dependent on quick turn-round enabling them to make use of the speed given them by progress in naval architecture and marine engineering, and by building policies aimed at securing increasingly efficient service to passengers and shippers. To match progress in ship design, port authorities and operators of port services are vigorously improving their facilities for ship handling and, as is amply demonstrated in this paper, there have been built up expert techniques in cargo handling, transport, repairing, storing and documentation which together " turn the ship round." But in spite of modern techniques of turn-round, and in spite of faster, more efficient ships it is an unpleasant fact that in the matter of time expended in port *vis-à-vis* that spent at sea, the position today is a complete reversal of that prevailing before 1939. Then, as an example, a cargo liner on say the Indian trade might reasonably be expected in a year to be under way and earning money for 196 days, with 169 days in port; today, she spends 167 days at sea and 198 days in port—and this despite the fact that her average sea speed is approximately two knots faster than her predecessor of 1939.

The fact that the economics of shipowning make companies constantly concerned that their ships shall be handled with dispatch, and that this paper has stressed the importance of the efficient dovetailing of a great diversity of skills and techniques to that end, does not rob the subject of shipping in port of its romance. Shipowners and port authorities throughout Britain are conscious of the weight of their responsibilities to the life and existence of the nation and much thought is being given to the future. In their building and modernisation programmes ports must provide facilities which for many years to come will be ample for the changing pattern of trade of ship design and of mechanical development. It is not given to man to forecast with certainty a future governed by so many imponderable factors but ports and shipowners are co-operating closely and fruitfully to ensure the fulfilment of their common interests.

Through the ports flows the lifeblood of the country; every warehouse and quay can be the site of a " British Industries Fair " in miniature or a clearing house for the products of farm, forests and factories, brought from the four corners of the world. Without efficiently equipped ports to receive, marshal and ship the goods rapidly, and without fast modern ships to carry them speedily to their destination, the country's all important export trade would be virtually at a standstill. Equally, there would be industrial and social paralysis without a measured and regular flow of imports. That is the measure of the importance of the British Merchant Navy and of the ports that serve its ships. It is to the credit of British shipowners and port authorities that the life of the country has gone on uninterrupted even in he grimmest days of war when dispersal of shipping brought many additional problems to the already onerous ones that occur daily in the lives of all whose business has to do with ships and shipping.

Retirement of P.L.A Vice-Chairman

Sir Douglas Ritchie

The Port of London Authority at a recent special meeting received with regret the resignation, owing to ill-health, of Sir Douglas Ritchie, who has been vice-chairman since January, 1946. The Authority elected Admiral Sir Alan Hotham as vice-chairman in place of Sir Douglas. Admiral Hotham sat on the board of the Authority as one of the appointed representatives of the London County Council from 1929 until June 30 last.

Born in 1885, Sir Douglas Ritchie was educated at Manchester Grammar School and Manchester University. He first held a number of appointments with municipal bodies in Lancashire and during the 1914-18 war he saw active service in France, and was awarded the Military Cross.

In 1923 he was appointed solicitor of the P.L.A. and held the dual office of solicitor and secretary from 1927 to 1938. He was general manager from 1938 until 1946, and during the recent war, exercised wide additional powers as chief executive of the London Port Emergency Committee. This appointment involved him in many problems and an immense amount of additional work.

Sir Douglas Ritchie's experience has been widely sought and respected in port operational and administrative circles. In the Dock and Harbour Authorities' Association, he served on the Parliamentary and general matters sub-committee from 1927 to 1949, being chairman for the last seven years; he represented London on the executive committee from 1946 to 1949 and was chairman from 1950 to the beginning of 1954. He has been president of the Association since 1954. He played an important part in the evolution of the port labour employment scheme which came into operation in 1942 under the auspices of the National Dock Labour Corporation, being a director of the Corporation and chairman of the London Board of the Corporation, and he was also one of the first members of the National Dock Labour Board in 1947. A knighthood was conferred upon him in 1941.

The Ports of Cyprus

Suggested Improvements

The following is condensed from a Report which has been prepared, at the request of the Colonial Office, but the Ministry of Transport and Civil Aviation, regarding the present condition of Cyprus Ports, and the measures which it is suggested should be taken to improve them with a view to increasing facilities for handling the island's trade.

Exports and Imports.

Of the principal exports nearly sixty per cent. by value consist of mineral products, such as copper and iron ores and asbestos. The remainder of the exports are almost entirely agricultural. The mineral exports are mostly handled through special terminals constructed for the purpose by the owners of the mining concessions, and such facilities do not come within the scope of the Report and recommendations. The agricultural exports are largely seasonal, and of these the large citrus crop calls for prompt and careful handling.

The imports are of a general character, of which machinery and iron and steel manufactures and wheat are the principal items in point of value. There is thus a heavier demand on port facilities for the handling of imports than of exports, much of which, as stated, is channelled through specialised installations. The tourist trade is an important invisible export, and is increasing.

The Existing Ports

The principal ports are:

Famagusta, on the eastern side of the island. Ships and schooners can berth alongside a quay, but they are limited to a draught of 22-ft. 6-in. and there is much congestion.

Limassol, in the South West, is no more than an open roadstead, and it is noteworthy that chrome ore and asbestos mined in the Troodos mountains are transported to Famagusta, a distance of 60 miles when Limassol is only 20 miles away.

Larnaca in the South East is a much smaller port than either of the above-mentioned, and exists in the shadow of Famagusta as regards trade.

Paphos and Kyrenia, in the West and North respectively, are quite minor ports, and their location in relation to producing areas and road facilities is such as to render them incapable of much expansion in the future.

Proposed Improvements

The writers of the Report have taken into account all the factors such as the hinterland transport amenities, the trends of local agriculture, the tourist trade and the increased use of the island by H.M. Forces. In addition it has of course been necessary to adopt a realistic attitude in relating the cost of suggested works to the present and future trade. The keynote of the recommendations which are given in detail below, is to provide deep water berths in order to eliminate the present congestion and delays. In detail the proposals are as follows.

Famagusta:

(i) **Deepwater Quay.** A quay to be constructed immediately north of Othello's Tower and extending for 2,000-ft. in a north westerly direction from the head of the western mole in the entrance to the Inner Harbour. The quay would thus replace that part of the shore known as the Turkish Beach and would be about 400-ft. wide at its southern end and 600-ft. wide at its northern end.

(ii) **Depth of Water Alongside.** The depth of water alongside should be 32-ft. In order to achieve this and similar depths in the approach channel and turning ground the area shown on the Plan will have to be dredged to that depth.

(iii) **Protecting Mole.** This should be built on the existing reef and extend for a distance of about 1,600-ft. from the northern end of Messanisi to White Rock. From this point it should curve gradually to wards a west-north-westerly direction following the shoalest water for about 2,000-ft. until it reaches the four fathom line. The stone needed for the construction of this mole could probably be obtained from local quarries and from material dredged from the harbour bed. The side of the mole should be pitched as necessary, except for 600-ft. on the southern side of its outer end; this should be surfaced and fitted with bollards in order that it may be used as a holding berth. This part of the mole should also be raised as necessary in order to afford protection to ships lying alongside from the strong north easterly winds which prevail in winter.

(iv) **Shore Access.** The quay at its northern end would lead directly on to an area of open ground which can be developed as required. The proposed quay area should be sufficient for the required shed storage. It is understood that the Government propose to build a new road linking this area with the Karpass and a new secondary road to Nicosia to the westward, and, by penetrating the City wall close south-westward of the north east Bastion, to connect with the existing quay in the Inner Harbour. Our proposal is that the whole of the short mole extending in a north easterly direction from Othello's Tower should either be razed to the level of the quay, or have an opening cut through it and that the recess in the quay immediately eastward of Othello's Tower should be filled in. Not only would this link up the existing and proposed quays by means of a clear space about 100-ft. wide, but it would appear that the necessity of penetrating the City wall to the south-westward of the north-east Bastion might then be overcome.

(v) **Grain Storage.** It is understood that it is the proposal of the Government to provide modern storage facilities for the importation of bulk wheat. This silo, together with its machinery for discharging bulk cargoes from ship and distribution within the building should form part of the harbour constructions and be carried out concurrently with them.

Limassol:

Deep Water Berths. The construction is recommended of three deepwater alongside berths at Limassol. These will be primarily required for the loading and discharging of cargo vessels, but berthage will also be required from time to time for passenger ships and vessels with military cargo. The berths proposed would have the same requirements as those from Famagusta, i.e. they should be 600-ft. in length and the depth of water alongside should be 32-ft.

Proposals for the lay-out of these quays are shown on the Plan; it will be seen that they extend westward from the entrance to the lighter basin now under construction, while protecting moles should extend to the southward of the lighter basin and from the southern end of the western berth. This berth is set at right angles to the other two and should be designed to take either general cargo or passenger traffic.

Shore Access. Road communications with the west are good, while many of the buildings inshore of the lighter basin have been purchased by the Government and are being pulled down in order that access to the port will be available by means of two main roads. There is, however, considerable room for improvement in the road communications with Nicosia.

There is some evidence that much rock may have to be removed during the dredging which will be necessary to give the required depth of water to accommodate ships in the new berths we recommend. This can only be established by taking systematic trial borings. If the cost of any scheme such as we propose proved likely to be prohibitive because of the presence of rock it would be possible to provide three berths at the end of a jetty running out from the knuckle of the lighterage basin now under construction to the five or six fathom line. Neither passengers nor cargo could be handled as efficiently under such an arrangement, however, and the scheme described above is much to be preferred.

Paphos:

If Paphos is to play its part in the increasing trade of the island three improvements should be carried out, namely:

(i) **Western Mole to be Extended about 250-ft.** A rubble breakwater should be built as shown on the Plan. This should tend to curb the depth of silt which it is understood reaches the harbour from the direction of the end of the mole. It would also form additional protection to ships lying alongside the jetty, but as only approximately seven days a year are lost due to bad weather, this is of secondary importance.

CYPRUS—DEVELOPMENT OF PORTS.
KEY MAP
Scale of Miles
KYRENIA
NICOSIA
FAMAGUSTA
LARNACA
CYPRUS
LIMASSOL
PAPHOS
PAPHOS
Soundings in Feet
Old Mole
Entrance Channel
EASTERN MOLE
WESTERN MOLE
PROPOSED EXTN TO WESTERN MOLE
LIMASSOL
Police Station
Customs Office
GOVT LAND
LIGHTER BASIN
PROPOSED EAST MOLE
PROPOSED W. MOLE
PROPOSED QUAY
TRANSIT SHEDS
VACANT LAND
Brick & Tile Factory
Keo Factory
AREA ZONED FOR INDUSTRY
LIMASSOL
PROPOSED MOLE
WHITE RK
BLACK RK
HOLDING BERTH
AREA TO BE DREDGED TO 32 FEET
PROPOSED QUAY
MESSANISI (North IS)
Ancient Mole (awash)
OXO IS
Dries in Patches
Karavolos Potamothia
Harbour Master's
Soundings in Fathoms & Feet thus 5.4
Tidal Range Mean Springs 1·0 Feet
Do Neaps 0·4 Feet
FAMAGUSTA
Scale for All Plans.
Feet 1000 500 0 1000 2000 Feet

Ports of Cyprus—continued

(ii) **Entrance and Harbour to be Dredged to 12-ft.** These are at present supposed to be dredged to 8-ft. We were, however, informed that the entrance channel had silted up to 6-ft. The bottom consists of sand and rock; the latter is said to be readily removable and is probably mainly boulders. If dredged to 12-ft. ships of 150 d.w.t. should be able to enter and leave in all weathers. In order to provide manoeuvring space for vessels berthing at the end of the new jetty it will be necessary to extend the dredged area about 200-ft. to the eastward as shown on the plan.

(iii) **Jetty to be Rebuilt.** In order that the trade of the port shall not be unduly interrupted, it is suggested that the new jetty should be built close to the eastward of that which exists at present. It should be about 200-ft. in length and 38-ft. wide to take two-way traffic. The "T" end should be 100-ft. long and of sufficient width to allow lorries to turn. The southern end of the jetty should project into the area which it is proposed to dredge to 12-ft.

Cost of Proposals.

It is considered that civil engineering works, including provision of the sheds needed in the first instance, should together cost about £5m. Harbour tugs whose purchase is recommended may cost about £¼m. but no provision is made within this figure for quay cranes, grain silos and intake machinery, nor any ancillary equipment which may become necessary as detailed planning proceeds.

The works proposed at Limassol can be executed with less disturbance to existing facilities than those at Famagusta and because of this it is considered that the former should be given the higher priority. The comparatively minor works at Paphos could conveniently be begun when those at Limassol are approaching completion.

The Question of a Free Port

The question of providing a free port was raised in official discussions and at meetings with some representative bodies. It is clear that for a free port, or a free zone within a port, alongside berths are essential. Any suggestion of using anchorage discharge, whatever the facilities ashore may be, is uneconomical and is also impracticable because of the scale of supervision needed.

It is considered that the demand for such a facility should be put to the test before attempts are made to meet it. However, it is recommended that the possibility of its later provision should be borne in mind in the detailed planning of any expansion of Famagusta or Limassol. If the recommendations of this report are adopted, both these ports may very well attract transhipment trade, which at times of particular disturbance in the Eastern Mediterranean has been considerable already. Should this happen, the strength of demand for a free zone in one or both of these ports will reveal itself more clearly. If plans have provided for it, very little beyond the provision of fences, some offices, and perhaps more sheds will then be necessary.

Port Administration

Under the present system the Customs Department is entirely responsible for the general ports and jetties. This arrangement is satisfactory where the normal duties of such a Department preponderate over those connected with the operation of the ports. The time has already come, however, when this is of doubtful application in Famagusta; it will no longer be true in Limassol if the present recommendations are adopted.

It is therefore thought necessary to consider divorcing port operation from customs collection by creating a new Department, or Directorate of an existing Department, of Ports. It would probably be found preferable for the headquarters of this organisation to be located with the central Government rather than in one of the ports. The appointment of a Port Manager at Famagusta would then be well worth consideration, even with present resources; whether the present Port Superintendent, who would then be responsible to him, could combine the duties of Harbour Master with those of Traffic Manager if more berths were constructed would be a matter for further examination. At Limassol the appointment of a joint Port Manager/Harbourmaster, alongside the collector of Customs, would at present suffice; this would again have to be reconsidered if alongside berths are provided. In the other ports the present arrangements could well continue; those in charge would of course have to be responsible to two Departments.

Canadian Harbours

Excerpts from Annual Report for 1954

The nineteenth annual report of the National Harbours Board, covering the operations for the calendar year 1954, of the harbours of Halifax, Saint John, Chicoutimi, Quebec, Three Rivers, Montreal, Churchill, and Vancouver, and the Government grain elevators at Prescott and Port Colborne, states that while the volume of shipping entering the harbours showed a slight increase, the aggregate cargo tonnage in 1954 fell by about 4% as compared with 1953. Foreign inward traffic was lower by 3%, but foreign outward cargo declined by 15%, due to a reduction in grain exports. Domestic traffic registered a gain of 4%.

Good progress was made on the construction of new and improved facilities, expenditures on capital account being larger than in any previous year.

Vessel arrivals in 1954 numbered 50,891, the aggregate net registered tonnage being 45, 493,111. The comparable figures for 1953 were 49,961 vessels, aggregating 45,307,299 net registered tons.

Aggregate cargo tonnage in 1954 was 40,890,853, compared with 42,525,237 in 1953, the decrease being 1,634,384 tons.

Grain traffic showed a considerable decrease from the previous year, dropping from 13,120,888 tons in 1953 to 10,383,781 tons in 1954, a reduction of 2,737,107 tons, or 21%.

Considering other commodities with aggregate tonnages in excess of 200,000, there were increase in fuel oil, pulpwood, lumber, bituminous coal, logs, newsprint, cement, raw sugar, sand and gravel, crude gypsum, wood-pulp, hog fuel, and ores. Decreases were shown in crude petroleum, wheat flour, gasoline, and anthracite coal.

Foreign inward traffic decreased 330,432 tons, or 3%, and foreign outward traffic decreased 2,079,112 tons, or 15%, compared with 1953. Domestic traffic inward increased 608,956 tons, or 5%, and domestic traffic outward increased 166,204 tons, or 3%, compared with 1953.

Income and Expenditure.

Operating income of all units in 1954 amounted to $20,258,671, compared with $21,032,018 in the previous year. The decrease was $773,347, or nearly 4%. Almost half of this amount pertained to grain elevator operations. Income from the operation of wharves and piers terminal railways and miscellaneous harbour services also declined.

Maintenance expenses in 1954 were $2,769,000, compared with $2,867,000 in the previous year.

Net operating income was $589,583 below that of the previous year, the comparable figures being $8,739,187 in 1954 and $9,328,770 in 1953.

After taking into account miscellaneous income debits and credits and charging interest and reserve for replacement of capital assets, operations for 1954 resulted in a net income surplus of $1,792,113, compared with a surplus of $2,406,514 in the previous year.

It may be noted that the grain elevators at Prescott and Port Colborne and the facilities at Churchill harbour were transferred to the Board for administration without the imposition of any carrying charges in respect of the capital investment at the date of transfer, and the surplus of $1,792,113 includes $1,036,924, as the combined net earnings of the facilities referred to, exclusive of such charges, including reserve for replacement of capital assets.

The Disastrous Cyclone Damage at Genoa

Causes of the Breakwater Failures Examined

by Dr. MARIO GRIMALDI
Harbour Engineer of Genoa Port Authority

THE question "Why did the breakwater fail?" naturally disturbs the minds of those who, like myself, earn their livlihood from our port. There are others too, who have an interest or connection with our City who are concerned. The answer is simple and unfortunately obvious: because the sea has been stronger than the defence provided by man.

But why then was the mole not built sufficiently strong? Why was it not strengthened if there were doubts about it? Furthermore, was it structurally weak in the first place, and kept secret? How did the disaster happen?

Construction of the Breakwater.

The breakwater wall, or mole, was constructed to enclose an area of deep water bordering the coast. This mole, which was commenced in 1916 and finished in 1933, was designed and built as a vertical wall 3,800 metres long and at that time it constituted one of the most important examples of its kind. When it was first projected, the existing breakwater defending the harbour was the original Duca di Galliera Mole, aligned east-south-east, and joined up with the old "Nuova" (New) Mole at the west point of the original crescentic harbour by a long north-south arm, now considerably widened and used as a mineral oil quay. The scheme comprised an extension of the Galliera mole by 409 metres at the south-east head, to protect the outer harbour; and a 3,378 metres prolongation of the Galliera Mole from the north-west elbow to the west, aligned about 12 degrees north of west. This arrangement thus enclosed a parallel strip of the sea along the coast now named the Lanterna and Sampierdarena basins respectively.

The discussions between the technical and contructional experts from all parts of the world went on for several decades. The stumbling block was the indecision arising from the differences of opinion between the supporters of the rubble mound type and the vertical wall type of breakwater. The argument is, still to this day, inconclusive. In the past sea defences directly exposed to the assaults of the open sea had been executed throughout the world by dumping huge masses of tipped rubble or artificial blocks on the sea bed. Instances of damage and sometimes serious disasters were not lacking in Italy, as well as abroad, and, in almost every case, mound or wall, it was decided that the seas assaulted the works with exceptional violence. This was particularly so at Genoa in the gale of November 27, 1898, which caused the destruction of 400 metres of the old Galliera Mole, which was then modern. The history of maritime engineering is replete with like failures. Nevertheless, the supporters of the newer vertical wall type maintained that their use should impede, or avoid, the break of the waves and provoke the reflection without shock (French theory of the clapotis, or stationary wave), thus avoiding the break blow and tendency to movement of material that experience shows to be inevitable in rubble mounds.

The new tendency, supported by numerous experts of all nations, has had an extensive following and important works of vertical walls of simple type, that is to say with the wall founded on the sea bed, and of the type called "composite" (in other words, a vertical wall founded on a base of rubble) have been, and continue to be, constructed all over the world. The theory and calculations appear highly convincing and cannot be challenged in that respect. The technical advantages for construction purposes are obvious; it is more rapidly constructed, less subject to damage on exposed coasts during construction, first cost is less, and so is subsequent maintenance.

The sea however soon demonstrated that not even the new system was perfect. Violent gales produced serious disasters in many works of the new type; engineers were forced to improve and reinforce designs still further, and each time they were satisfied they had been able to achieve a reasonable degree of security. But in the constant battle of man against the elements, and in particular against an element so fickle and so unpredictable as the sea, the trouble was not ended. The fact is that no expert was then, and is not to this day, in a position to calculate exactly the maximum limit of the destructive forces of an exceptional gale. The uncertainty of theoretical assumptions, the incompleteness of experimental data, almost always surpassed by nature, make it impossible to classify these forces with scientific exactitude in a sufficient number of exceptional events. On the other hand, an outer breakwater is a work of such great bulk and high cost that the designer is inevitably constrained to resist the temptation of so increasing the dimensions that the scheme becomes financially impossible of realization. The constant conflict between prudence and cost is unending. Therefore projects of such magnitude as breakwaters have to be a reasonable compromise between the two.

It cannot be denied that the designers, now all deceased, of the Genoa breakwater were the most expert authorities of the epoch. They followed the dictates of a reasonable prudence according to the notions of the time, and the available experience. The works were then in their entirety the strongest and most robust in the world; albeit the inevitable need of economy had induced certain "cheeseparings" which, although almost universally adopted, good sense must later have decisively deprecated. In the course of the works (the duration of the construction lasted 18 years) account was taken of the experience gained in the meantime at Genoa and elsewhere. The breakwater cross section was twice modified as to the type and dimensions of the blocks of the under water structure. Also more powerful and modern methods of working were developed. Incidentally, it is understandable that the solid concrete blocks which were used for the construction of the last 1,850 metres of the western breakwater and the extension of the eastern arm, each weighing 400/450 tons, were proudly named "'cyclopean." When completed, the two new arms of the harbour breakwater about the existing Galliera Mole were composed for about half their total length of blocks of the earlier "cellular" type and of the later modified "well" type, whilst the remainder and most recent were of the "cyclopean" blocks type.

It would appear that, to the question "Why was the breakwater constructed in this manner?" the reply must be "because the science and technique of maritime construction were then dominated by the designers and constructors who respected prudence as a constructive criterion, and therefore adopted these dimensions."

Why was the Breakwater not strengthened?

By the time the breakwater had been completed in 1933, there had already been damage to the first stretches of the construction, comprising the "Cellular" and "well" type of units, which raised doubts as to their suitability. After careful consideration (1926-1927), the engineers adopted the solid block "cyclopean" type of cross section for the remainder of the walls to be built. Under the more violent gales during the construction period, some underwater units of the two earlier types were seen to be damaged at the outer ends, possibly because of the movement and pressure of the superstructure. In consequence, serious holes were caused in the walls. It was found almost impossible to deal with them locally, and therefore the engineers decided to seal up these danger spots by the construction of a counter wall against the outer face of the damaged stretch. This was before the last war and the repair was slow and costly. Meanwhile, the huge Galliera Mole of rubble to which the new work was linked received a much needed reinforcement.

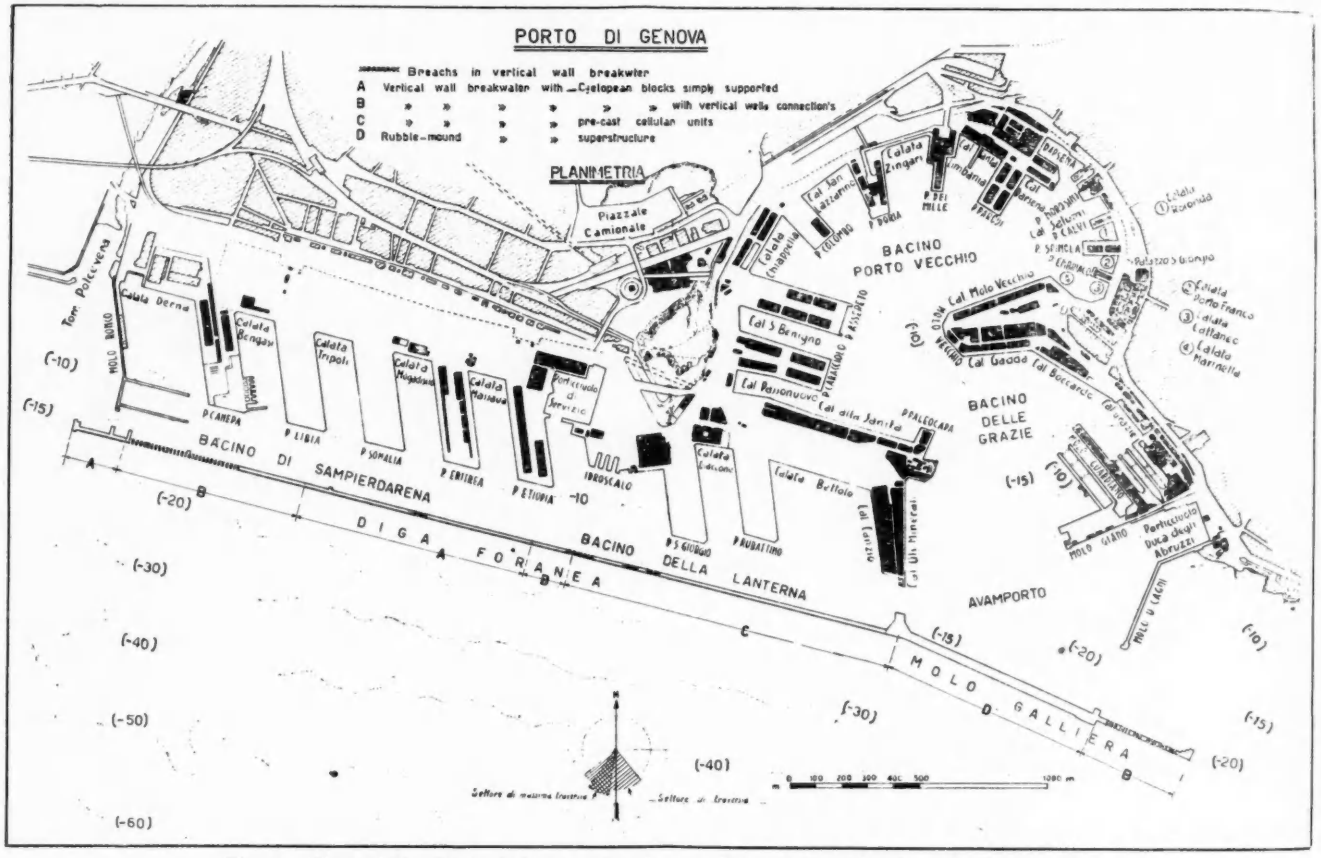
The enforced suspension of works of maintenance during the war and the extensive damage sustained during hostilities, such as an 80 metre breach blown up by the Germans in 1945, weakened the

Disastrous Cyclone Damage at Genoa—continued

stability of long lengths of the breakwater and naturally caused great anxiety to the port administration. Eventually the works of maintenance were resumed, and from 1945 to 1949 the war damage was repaired at a cost of 280 million lire. Added to this, from 1949 to 1954 the Port Authority alone spent 520 million lire from its own funds to close the breaches successively widened by the seasonal gales. Also, in 1950 the Galliera Mole, which had been severely damaged by winter gales and was consequently as precarious as the newer block walls, was repaired, and the substructure strengthened by the addition of external counter walls. By 1953, the whole of the works were considered to have reached a degree of security equal to the pre-war state of the entire wall. There still remained, of course, the possibility that new gales might produce further local damage, as indeed happened in the winter 1953-1954 and again in the winter 1954-1955. The wall, like many other exposed breakwaters, continued to cause anxiety and required ceaseless and difficult maintenance work, such as the sinking of compressed air caissons of reinforced concrete in places directly exposed to the open sea. Nevertheless, the overall condition did not justify undue alarm; neither in the stretches more subject to damage, nor in the lengths of the less troublesome cyclopean blocks, which still remain undamaged after 20 years of storms, with the exception of a number of fractures in 1953, which were most probably caused by an underwater explosion.

The work of repairing these was interfered with considerably by bad weather and successive breakages of adjacent blocks and was not successful. It therefore became necessary to radically rebuild the whole of the 14 metre gap affected. This was undoubtedly an exceptional failure, and has not been repeated since in any other part of the wall, not even under the terriffic hammering of the last cyclone in which the damage was of a totally different kind.

Meanwhile, in Italy and abroad, maritime engineers were perturbed by the study of the disasters which had taken place at Catania (1933) and Algiers (1934). It was said then and repeated later that such disasters, provoked by gales of exceptional violence had happened in situations more exposed than Genoa. Yet the doubt as to the strength of the walls was present, and demanded the attention of the scientists. However, the designers of maritime walls must always proportion them to the presumed maximum violence of the sea in the locality where they are required. Having considered the weaknesses, the scientists favoured substructures of monolithic reinforced concrete blocks even stronger than the cyclopean blocks. They also favoured sinking the foundations of the vertical wall to greater depths, as has since been recommended in the last International Congress of Navigation, Rome (1953).


PORTO DI GENOVA
Breachs in vertical wall breakwter
A Vertical wall breakwater with Cyclopean blocks simply supported
B » » » » » » with vertical walls connection's
C » » » » pre-cast cellular units
D Rubble-mound » » superstructure
PLANIMETRIA
Piazzale Camionale
BACINO PORTO VECCHIO
BACINO DELLE GRAZIE
BACINO DI SAMPIERDARENA
BACINO DELLA LANTERNA
AVAMPORTO
DIGA FORANEA
MOLO GALLIERA
Torr. Polcevera
Calata Derna
Calata Bengasi
Calata Tripoli
Calata Mogadiscio
Calata Massaua
Calata Bettolo
P. LIBIA
P. SOMALIA
P. ERITREA
P. ETIOPIA
P. GIUSEPPE MAZZINI
P. GIUSEPPE GARIBALDI
P. GIUSEPPE VERDI
P. GIUSEPPE MARCONI
P. GIUSEPPE DORIA
P. GIUSEPPE MILLE
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P. GIUSEPPE MILLE
P. GIUSEPPE CAVOUR
Cal Molo Vecchio
Cal S. Benigno
Cal Gaggio
Cal Boccardo
Cal della Sanità
Cal Lanterna
Cal Chiappella
Cal Zingari
Cal Arena
Cal Bettolo
Cal Ufficio Finanza
Cal Lanterna
Cal Lanterna
Cal Lanterna

Disastrous Cyclone Damage at Genoa—continued

would have improved it but explicitly concluded " such a solution would mean an expense of 5,000 million lire which, even if it were available, would be disproportionate compared with the small risk that would be run by leaving things as they are, since the experience of almost 50 years has demonstrated that during an exceptional gale the damages are restricted to limited stretches which have been weakened either by gale damage or ineficient construction. We cannot even entertain the idea of converting only the separate weak stretches of the actual wall into rubble mound, leaving the vertical wall as it now stands, since the places where the rubble slope joins to the vertical wall will represent weak points that would have to be protected with wave breakers detached from the works. Furthermore, should the number of transition points be numerous, the cost of the wavebreakers would be excessive. It is therefore considered premature to undertake any conversion of the vertical wall into one of a rubble mound, particularly in view of the heavy cost involved. It is therefore suggested that for the time being conservation of the wall should be carried out with a more intense and efficient maintenance."

To these suggestions the Port Authority conformed exactly, as much for the indisputable authority and the high competence of the members of the Commission, as for the impossibility of providing

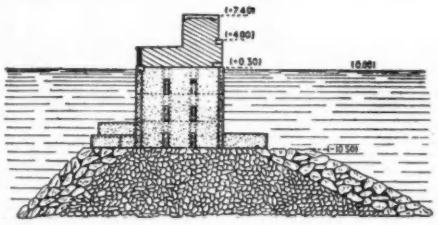


Fig. 2. Cross-section of the vertical wall breakwater of pre-cast cellular units of Type " C " (See Fig 1).

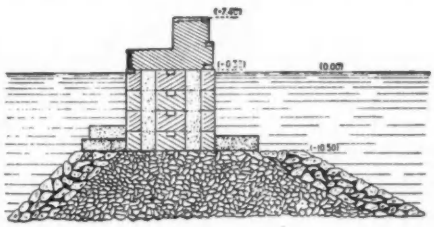


Fig. 3. Cross-section of the vertical wall breakwater of four tiers of concrete pre-cast blocks with central walls later filled with in situ concrete Type " B."

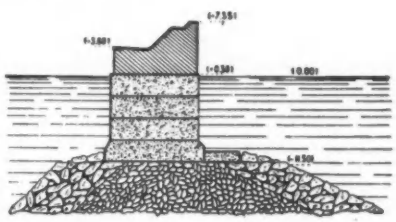


Fig. 4. Cross-section of breakwater of four tiers of mass concrete blocks. Type " A "—base one metre lower than other types.

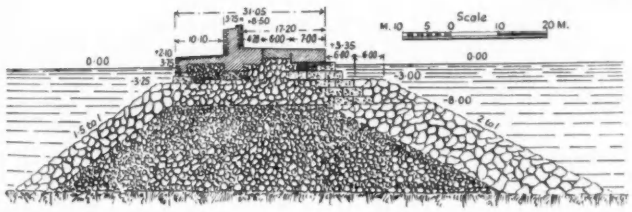


Fig. 5. Cross-section of the old breakwater. Galliera mole of rubble, Type D—undamaged.

from its own financial resources more expensive works. The technical staff also agreed with the conclusions of the ministerial commission.

Incidentally, although the Port Authority might have been concerned over the high estimated cost considered by the technical advisers to be necessary if the wall were converted to a rubble mound, yet it would probably have been able to find in a short time the funds required, and also to obtain the necessary ministerial approval.

Even so the progress of the works by February 19 last would not have been able to save the breakwater where the great breach occurred, for that, as has been pointed out above, had never given any trouble in 20 years and would not have been included in the improvement scheme.

Were there hidden deficiences?

The answer appears implicit in what has been said above. For the stretch of the solid cyclopean blocks there were certainly none, and the very nature of the damage caused by the cyclone has demonstrated this. As to the stretches of in situ concrete filled blocks—cellular and well—it is evident that underwater holes in the face still existed in some parts (in all, 27 ends of blocks had been gouged out by the last winter gale four weeks before the disaster, and, as soon as these had been noted, an immediate programme of repair was drawn up to be undertaken as soon as the weather allowed). Undoubtedly the numerous mendings or patchings up, effected during so many years on the body of the mole in order to close up breaches and seal up minor damages constituted points of relative weakness, regardless of how much attention and care had been exercised in the work. It is seldom satisfactory and always difficult in works of this kind where the new has to be joined with the old, especially when done under water in an open sea. A testimony of the good execution of many of these repairs, however, was that they withstood satisfactorily the tremendous test of the February 19 tempest, although a few yielded partially under the terrific hammering hour after hour. Other places, however, which had never before been damaged or repaired were carried away.

It is now recognised that the depth of the foundation of the vertical wall in the rubble mound benching, or berm, was a profound deficiency. Another almost obvious deficiency was the excessive fragility of the cellular and well blocks which would have certainly given a greater resistance had they been suitably reinforced. The non-monolithicity of the wall with too many and too extensive coursing of horizontal joints is now revealed as particularly fatal; such structural weaknesses cannot be eliminated except by the use of large reinforced concrete caissons.

Furthermore, the height of superstructure of " in situ " concrete including the shelter wall appears to have been excessive in relation to the other dimensions of the wall.

Arising from these last two points there is an important detail of construction, and that is that in such works a stricter investigation should be made into the actual resistance, in sea works, of the constituents and proportions of the concrete mixture. It now appears to be confirmed that the use of lime and pozzolana should be limited or avoided.

How did the failures occur?

The concentration of the violence of the waves took place on that stretch of wall near to the western entrance of the Sampierdarena Basin where the large breach occurred, and in that zone of the sea-bed where the depth contours of the sea form a submerged valley to the shore.

The breaches differ in nature and character for the different types of cross section (solid, cellular and well blocks). The first serious collapse occurred in the solid block length near to the west entrance. On February 19 at 15.45 hours the heavy seas which had been running for some hours overtopped and sheared off, suddenly and simultaneously, 150 metres length of wall. This gap continually widened and eventually extended to 450 metres. Later examination in this zone by divers showed that the fourth course of blocks and the in situ concrete superstructure had been cleanly slid into the harbour from the lower courses of blocks. The lower three tiers of solid blocks and the apron block at the toe remained in place, for the most part undamaged and undisturbed. This substructure had remained in stable condition from the base to about 3.5 metres below mean water level; the superstructure 10 to to 11 metres high and with a 12 metres base had, however, slid off and overturned bodily into the harbour.

Two hours later, on the same day, with the sea still running high, a first small breach was opened in the east extension of the Galliera Mole, which was constructed of well blocks, and during the night and following day several more gaps of from 5 to 80 metres were opened in the same stretch and in the middle of the west mole of

Disastrous Cyclone Damage at Genoa—continued

cellular blocks. Some partial gaps were also made where blocks had already been displaced in spite of the gradual lessening of the force of the gale. The well and cellular blocks did not shear off like the cyclopean blocks as they were held firmly by the central nucleus of concrete which formed the fill of the wells and cells of the precast skeleton blocks. The end faces of both types were shattered and broken up gradually in great numbers under the heavy blows of the sea. This provoked the undermining of the superstructure and also the breaking up of adjacent blocks below. In that portion of the breakwater destroyed by the Germans in 1945 and later repaired by the port staff, only a slight sliding of the solid blocks at the horizontal joints occurred. It is remarkable that the first damage of the gale and the most extensive in length and depth was in the most modern and the least troublesome stretch of the Mole.

The gale was the product of a very strong south-west wind and was of a short violent ascending phase and a long descending period which aggravated the damage produced at the peak of the storm. Indeed, on the morning of February 18 the sea had been tempestuous but on the morning of the 19th, it seemed to be dying down, and then suddenly backing to the south it became extremely violent. Such a violence has never before been experienced in living memory at Genoa.

The barometer stood at 739.2 mm., and the velocity of the wind in squalls rose to 123 kilometres (74 m.p.h.). The waves were most irregular, at one time apparently coming from the dominent south west, then from the sirocco (south east), then a combination of both; their height could not be accurately measured but those more experienced to judge conservatively computed the wave height to be not less than 7 metres. The break of the waves at the wall produced water jets of fearsome height which, later, from documentary photographs were calculated to be 150 metres high.

Conclusion.

The alarming disaster had two causes; the exceptional meteorological circumstances and the past and present insufficiency of knowledge of maritime construction. It is easy now, after the event, to mathematically confirm that the unit pressure which provoked the sliding of the upper mass of the mole of solid blocks must have been considerably greater than that generally foreseen, or expected, in the current best practice of maritime construction, and also to prove with dramatic evidence the serious danger to the stability of the mass provoked by the upward pressure created in the horizontal joints. Such criticism is beside the point. The disaster has occurred within our experience—and it is for the future to profit.

Yet again the forces of the sea have prevailed over the defences of man. It serves as a hard lesson and a fresh warning to the designers of future works.

OFFICIAL NOTICE issued by the Port Authority of Genoa (Consorzio Autonoma del Porto di Genova).

Regarding the many inaccurate accounts of the damage caused by the exceptional violence of the tempest of 19th February last to the defence works of the Port of Genoa, the Port Authority officially states that the reduced functioning of the port equipment as a consequence of the said damage is limited to the Sampierdarena Basin only, and solely to periods of strong winds from the south and south west, which seldom happen and then only in the autumn and winter months. The Port Authority therefore assures that the Harbour of Genoa is always ready and competent to deal with the same volume of traffic as previously without any danger for the security of vessels.

Progress in Timber Design and Research

Annual Report of the Timber Development Association

The 21st Annual Report of the Timber Development Association, Ltd., which has recently been published, deals with research, design and promotion, in trade, industry and commerce. It gives information on the Association's activities during 1954, and the folowing items of interest to marine engineers have been extracted.

On the recommendation of the Ministry of Works' Advisory Council for Building Research, special consideration has been given to the problem of long-span roofs. The largest roof designed by the T.D.A. has a span of 106-ft. 8-in., but the mere extension of span is not the sole problem. Roof coverings which will permit a wider spacing of purling or trusses, and compact columns which will withstand increased wind loads without encroaching on valuable floor space are also needed.

Research into the properties of curved or corrugated plywood has suggested the possibility of increasing span between purlins of most commercial roof coverings from about 6-ft. to 20-ft. or more. Units of 13-ft. 6-in. span which have been developed in 4 mm. and 6 mm. ply offer considerable promise. An asbestos-cement covering to afford an incombustible outer surface was suggested to the Universal Asbestos Company, and has been developed experimentally. This T.D.A. Plywood Roof is covered by British Patent.

Preliminary bending, torsion and compression tests on a 25-ft. quarter-scale model of a compact built-up column with a framed zig-zag web, have proved satisfactory, and the column has been incorporated in a commercial design for prototype construction.

This research has enabled the T.D.A. to give advice to member firms wishing to renew or increase their storage accommodation and has resulted in work being commenced on a design for a transit building 500-ft. long by 150-ft. high by 21-ft. clear height, to be submitted to the Inland Docks and Waterways Management.

A design has also been adopted by the Mersey Docks and Harbour Board for an 88-ft. clear span roof, with prefabricated tongued and grooved roof units. These units are of unusual design, spanning a distance of 15-ft. between girders, and full-scale tests have been carried out at the laboratories of Messrs. David Kircaldy and Son. Prior to the placing of the construction contract it is proposed to test a complete roof girder.

The experimental groyne at Shoreham which was constructed of seven different timbers to test their wearing qualities, has now undergone a full year of service, and the results and measurements taken have been published.* No destruction due to storm has occurred, but abrasion has proved very extensive.

The timbers used include greenheart, mora, wallaba, brushbox, opepe, mubura and home-grown oak, and of these, the brushbox has proved to be the most resistant to abrasion. However, the mubura and home-grown oak, and those timbers in the Eastbourne groyne have not yet been examined as they have not been subjected to a full year's exposure.

The experiment at Shoreham Harbour is continuing and additional specimens have been added to those already submerged. Half-yearly inspections were made of the new timbers which replaced those destroyed last year and all specimens, except keruing and basra, showed evidence of only limited attack by teredo. It is thought, however, that this may be due to extensive pile-driving on the new harbour works, which may have caused sufficient shock-waves to destroy teredo larvae during the free-swimming stage. Additional specimens of timber have been submerged and the experiment is continuing.

The experimental timbers which had been in continuous service for 14 months in the irrigation stack of the North Thames Gas Board's cooling tower at Southall, were examined for the first time in May 1954. Of the six timbers used, virtually no deterioration was found in greenheart and ramin. The longer lengths of sapele, mora, and British Honduras pitch pine, showed slight warping and twisting, but this may have been caused by drying-out from the normal wet condition, during the inspection period. Agba and ramin does not appear to be significantly different in performance to the European redwood used in the remainder of the construction. The experiment is being continued.

The fourth edition of "United Kingdom Port Analysis" was prepared during the year. It analysed, port by port, the exact quantity, and value of every class of wood and timber arriving from abroad in 1953, showing also comparative figures for 1938.

* See the TDA Quarterly Review for July, 1954, and the further data in "The Dock and Harbour Authority" for March, 1955.

Commodity Infestation in Ports

VII. "General Considerations - be Vigilant - be Careful"

By W. McAULEY GRACIE
(Director and Chief Adviser of Disinfestation Limited).

As we come to the close of this series of articles on commodity infestation in ports, we would do well to look back over the way we have travelled. We commenced in February last with a World tour on which we "travelled with the goods" from the Countries which supply many of our essential food imports. We have found that we have to pay for our experience of infestation and the bill we have to meet includes provision for the travel and food requirements of the animal and insect pests with whom we have been fellow travellers.

On realising the economic significance of infestation in international commerce, it was our concern to discover the steps being taken in the public interest to mitigate the spread of an evil which was so burdensome to the general community. So in the second article we were at pains to ascertain the recognised duties and relaxations provided and aimed at reduction of loss and avoidance of unnecessary interference in the process with essential trade.

During the course of an investigation into the nature and extent of commodity infestation, as covered by articles 3 and 4, we have been profoundly shocked to discover the high rate of prevalence and the vast extent of commodity loss and damage attributable to rats and mice on the one hand and destructive food-insect-pests on the other.

We have then turned our minds to the problems of the warehousekeeper with a view to ascertaining whether the conditions under which his trade has had to be conducted in the past, were not capable of substantial improvement and this aspect of the general problem was considered in articles 5 and 6. We have satisfied ourselves that the storage of food intended for human consumption should be such that the stocks of food would be subject to hygiene care at least as high as that maintained in a well-kept domestic larder. We have also seen that much good can be obtained by regular and thorough cleaning of warehouse space as it becomes available and prior to its re-occupation. Undoubtedly, it would be a good thing and greatly welcomed by the good warehousekeeper if the owners of stored food commodities regularly satisfied themselves that their commodities were being well looked after by those in whose hands they had placed them, until wanted for distribution. It is a truism that where a man shows that he takes a real interest in what happens to his goods, there is the greater pleasure in providing service to his requirements. There is a good analogy in the case of the chef who takes a special delight in the preparation of a worthy meal for a discerning and appreciative client. If there should still be any indifferent warehousekeepers, it would have a tonic effect on them if their clients paid attention to the conditions under which their stocks were kept and contrasted them with the best practice in warehousekeeping in their areas. Soon there would be no indifferent warehousekeepers.

However careful the warehousekeeper may have been and continues to be, he can have no absolute guarantee against the introduction of infestation into the structure of his premises or in the commodities newly arriving there. It may well be that unavoidable circumstances have been against him but it is and should be his constant care to stop infestation in its incipient stages, and thus prevent its getting the upper hand. He should be prepared to make up his mind speedily on becoming aware that intestation has entered his premises, that effective measures must be taken and taken at once. If he vacillates or adopts a half-hearted policy, the infestation will gain in strength and extent. It is not a normal combination for precision in the detection of infestation, and for skill in the art of its control, to reside in the person of the individual warehousekeeper. He has many other technical problems with which to deal. The necessity for the use of a specific control measure is not affected by whether or not the application of that particular method is within the competence of the warehousekeeper. What is really important is that the operation should be based on skill and knowledge.

Effective pest control consists of much more than the destruction of the particular form of undesirable life against which the action is taken. It is no less important that in the process there be no damage or undesirable physical change in the host commodities as the result, in particular, of unsuitable chemical treatment.

Let us remind ourselves once again that, as commodity infestation in its incipient stages, not infrequently "travels with the goods" and is not easy to discover, perfectly clean structures may soon be fouled by the the introduction of infested commodities, with resultant rapid build-up of insect life in all such commodities present. Moreover, there are well established cases where clean structures containing hitherto insect free commodities are infested by entry through

Manual cleaning of warehouse. Removing pupal, grubs and debris from floor interstices.

Clearing debris by vacuum cleaner from crevices and cavities.

Commodity Infestation in Ports—continued

windows, ventilators and doors of flights of food moths and windblown insects. In cases such as those indicated, the use of appropriate toxic chemicals is absolutely necessary if the food and its commercial storage life are to be preserved. Stress is again laid on the choice of chemicals which are capable of being aired off and leave no harmful residues in the food.

The moral of all this is that the prudent warehousekeeper will prefer that where chemical insecticides or rodenticides are to be used in his premises and in the presence of the contained commodities, this should be made the responsibility of reputable people well qualified in the art of infestation control and not to be entrusted to workers, however zealous, if they are not possessed of the requisite qualifications. Some little time ago, in the Monograph Series of the World Health Organisation, there was a publication on toxic hazards by a British research worker who stated "Stored food, especially grain, is liable to very serious depredations by insect pests." So far so good, but when he goes on to say "in this particular case, as much could probably be gained by general hygiene and a better cleanliness in storage places as by the use of chemicals," anyone with practical knowledge of the infestation problem and experienced in commodity movement and storage must raise his eyebrows at this unqualified and uninformed assertion.

Briefly, the position is that the alarming facts are there; science has made available the requisite knowledge; skilled workers are applying that knowledge increasingly; an adequate act has been placed on the Statute Book; the Government has provided research organisation in constant search for new and improved ways; and through its Departments of Agriculture, maintains a skilled advisory and inspection service throughout the country; while the Local Authorities are active, within their powers, in stimulating the more limited rat repression work.

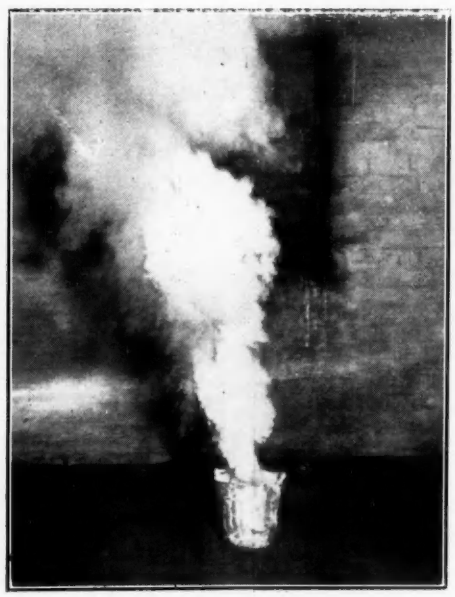
There could be some measure of agreement with the opinion quoted above if it represented a plea that toxic chemicals for pest control should not be used on or near stocks of food commodities except under skilled supervision and by qualified operators.

In the fairly considerable list of chemicals with effect against insects, rats and mice, there are wide differences in mode of action and killing efficiency. Similarly there is a varying range of susceptibilities of different kinds of insects and animals to the same poison. It happens that an animal of large size may succumb to a dose from which a much smaller animal could survive. It cannot be claimed that any pest control material, of itself, is beneficial to the commodities on or in the presence of which it is applied, except so far as it destroys the unwanted creatures. Indeed, it must be emphasised that serious risks to health may result from the splashing or scattering of toxic chemicals in food warehouses. As already pointed out, it is a necessity that — but only under strict rules — chemicals of strictly limited range have to be used on or in the near presence of foodstuffs, but it still is a regrettable necessity and one which justifies the practice of the art being limited to well qualified workers who fully understand what they are doing and the things to be avoided.

All this somewhat painfully lengthy dissertation and warning might be put tersely as do not play about with chemicals—where they have to be used get the expert in to do it.

Chemical control of infestation whether by insects or rats and mice fall broadly into three classes i.e. fumigation, stomach poisoning, and contact poisoning. Some of the chemicals employed may have a primary function such as fumigation but also possess a secondary function as a stomach poison or even as a contact poison.

Mist spraying with fine nozzle adjustment.



Smoke generator spreading an insecticidal layer in an empty warehouse.

There is in fumigation practice a group of highly toxic chemicals such as Hydrogen cyanide, Methyl-bromide and Ethylene oxide, which, quite rightly, when used in general fumigation, are to be applied only by specially qualified fumigators whose procedure is governed by instructions issued by the Home Office, pursuant to Act of Parliament. The primary purpose of the instructions or regulations and the associated advice, is the safety of those who may conduct or be in close proximity to the general fumigation operation or come into the risk area before the premises have been certified to be clear of gas.

These highly toxic gases are essential in stored products work where there is need for getting at insects in the several stages of the life cycle, when hidden right inside commodities, packages etc. The selection of the fumigant must depend upon the physical properties of the commodities to be treated and obviously chemicals which are capable of being absorbed and retained in the treated commodity are to be avoided in favour, as a general principle, of the fumigant that can be readily aired off leaving behind neither residue nor taint in the treated commodity. It may be taken that the real risk is that these highly toxic gases may be inhaled by those within the risk area during the fumigation or before gas clearance has been effected. Any suggestion of risk to those who later eat food, some or all of which may have been fumigated, can be ruled out providing the correct fumigant was used followed by adequate "airing out."

Approved types of gas-proof containers may be employed as fumigation chambers and are exempted from the provisions of the safety regulations imposed by the Home Office under the Hydrogen Cyanide Act, which Act is capable of application to other lethal gases.

It is imperative in the practice of fumigation by highly toxic gases that in the interests of human safety and efficient fumigation, there should be no leakage of gas from the specific premises or parts of premises brought under fumigation. The sealing of premises preparatory to fumigation is an expert operation and only to be performed by, or under the strict supervision of, a qualified fumigator. It is not infrequently the case that for structural reasons, it is practically impossible to make the building absolutely gas-proof and such a building as cannot be made gas-proof is not a suitable structure in which to conduct a general fumigation. This can be very unfortunate as the type of infestation and its deep-seated character may be such that fumigation would be the most effective remedy and the unsuitability of the premises for the conduct of this operation of fumigation, might well necessitate a long drawn out series of less drastic treatments before equivalent clearance can be obtained.

During the war years when reserve stocks of bagged cereals had to be held, for long periods, in extensive frame buildings and other premises never designed for such storage, it was necessary to improvise methods

Commodity Infestation in Ports—continued

for the destruction of insects and rodents by fumigation within premises, themselves unsuitable for general fumigation. The first essential was that the goods should rest on a solid floor and that the piles should be closely sheeted down, lightweight gas-proof material being used for the purpose. Numbers of these special sheets were used to cover individual stacks of up to 2,000 tons of grain, a simple method being devised for the folding of adjacent sheets, while all round the base of the stack gas tight conditions were maintained by lengths of small link chain which held the overlay of the sheets flush with the floor.

Small bore pipelines with atomising nozzles were introduced under the sheeting for delivery of the fumigant—Methyl-bromide. In this way a vast quantity of cereals was disinfested of insects, rats and mice in circumstances where otherwise fumigation in situ would have been impossible, and movement for fumigation, prohibitive in cost.

There may be considerable scope for the development of this method, where it is not practicable to place an entire structure under fumigation. This class of work should of course be left to the qualified fumigator.

It has already been stated that for small quantities of commodities in need of fumigation, fumigation chambers can be readily devised and may be approved for exemption from the Fumigation Regulations. It should be remembered that the effectiveness of a fumigation depends in the first instance on the concentration of the fumigant in the atmosphere and secondly on the period for which that concentration is maintained. A low concentration for a long time will furnish results equal to those of a high concentration for a short time. The fumigator always makes allowance for the absorption of the fumigant by the commodity and its packing material. The specially important consideration is that although the fumigant should be as toxic as possible to the widest variety of insects and mites, it must yet be such that no harmful residue should be left in the treated commodity and there should be a complete absence from taint, after the airing out period has expired.

The special value of fumigation is the ability of the gas to penetrate in lethal concentration into boxes of dried fruit; into bales of dates; into hogsheads and bales of tobacco; into sacks of flour and into the interior of grains. It is a useful reminder for it to be restated that it is too much to expect of good fumigants that they should make their way in full strength through cracks, crevices etc., filled with dust, insect webbing, and commodity debris. Thorough cleaning prior to fumigation is a worthwhile expense.

In the destruction of rats and mice, rodenticides, other than fumigants, are mainly ingested in attractive bait materials and taken through the alimentary canal. These materials are dependent for their efficacy on reasonable correct estimation of the pest population present, and on the judicious placing of baits to ensure their being well taken by the intended victims. Some of the metallic poisons used as rodenticides unfortunately are highly effective against human beings as well as against rats and mice and are so dangerous that they ought not to be in the hands of amateurs or be kept out of "poison" boxes under lock and key. Being satisfied that these strong poisons ought to be reserved for use in cases of absolute necessity, and then only by skilled workers, the author does not propose to dilate on the merits of these particular materials, beyond saying that they certainly have merits but only when used skilfully and with full knowledge and responsibility on the part of those who use them.

A stack of grain under fumigation inside a warehouse which itself could not readily be fumigated. Note the gas-proof fold joining sheets, and the close link chain maintaining gas tight conditions at floor level.

The insecticides used against stored products pests, apart from the fumigants, are chiefly contact poisons, that is to say materials which, when brought either as liquids or solids into contact with insects, can penetrate through the skin—and poison the insect. The contact can be secured either by direct spraying or dusting on to the insects or mites or by treatment of the surfaces over which they may move.

It is again necessary to record the fact that no single panacea has been found despite much scientific research. The author would be failing in his duties to the readers if he did not emphasise that insect pests of food are at least as tenacious of life as are human beings. Such success—and it is considerable — as attends sound commercial infestation control is achieved by the consideration of all the factors surrounding a particular infestation, and the influence which those several factors may have guides the selection from a variety of different measures of that or those most appropriate to the circumstances in which the particular infestation is present. in this field of work, diagnosis and prognosis both have an important part and the ultimate success of any operation must naturally depend upon the accuracy of the diagnosis and prognosis and of the mode of treatment prescribed for the particular case. It having been said that there is no single panacea there is little hope of finding that great boon in a container on the shelf of a tradesman who has not seen and assessed the trouble and based his prescription upon it. So much depends upon the study of the particular conditions, the constitution of the preparation, and the manner of its application that the chief ingredient in the success must necessarily be the "know how" of the person charged with responsibility for eliminating the trouble without damage to the goods. Excellent properties attach to the chemicals developed for pest control, but those properties can be of best advantage when used in the right way and in the right context. It is not to their discredit that the emphasis is here laid on skill and understanding in use.

Let it be remembered that to achieve control of infestation means much more than killing a proportion of the insects or mites. In view of their high powers of reproduction real control depends upon the killing of a high proportion of the insect population. The purpose of control is to remove the capacity to restore the population to nuisance or economically significant extent. This may in fact mean that complete elemination must be aimed at in some cases whereas in others something less than complete extermination may have to be accepted. The following guiding points should be observed:

Commodity Infestation in Ports—continued

The insecticidal method must be appropriate to the particular conditions under which it has to be used. Pyrethrum is a valuable insecticide but not against mites. Pyrethrum has a considerable "knock down" effect against insects but as there is a substantial recovery, the addition of the newer insecticides D.D.T. and Gama B.H.C. converts the knock down into "kill." The spraying or dusting of Pyrethrum in moderation is not deleterious to the treated commodities, but insecticides containing D.D.T. and Gamma B.H.C. should not be sprayed directly on to exposed foodstuffs, unless by experts who can work to such fine limits as will not result in the amount present in the final foodstuff exceeding 7 parts per million in the case of D.D.T. and 2.5 parts per million in the case of Gamma B.H.C. A spray applied to the surface of a bagged commodity will kill caterpillars on the surface but not those within the bag. The insecticide must not cause any physical change to the treated commodity and should neither leave taint nor harmful residue.

It will be to the real interest of the warehousekeeper that he follows with close attention the condition of landed imports of cereals etc. now that there is a resumption of commercial control of such imports and of their internal storage, sale and distribution. During the period of Government ownership and control, the Government accepted responsibility as importers, for maintaining reasonable infestation control. Under the new conditions, that responsibility falls directly on the private importers, warehousekeepers, millers etc., their duties being prescribed in the Prevention of Damage by Pests Act, 1949. There may be resumption of trades in certain classes of cereals and cereal offals with high infestation potential. During the war those trades were interrupted and that led to a temporary freedom from particularly serious types of infestation. It is to be hoped that if these trades, with their heavy infestation potential, have resumed or do resume the use of our ports, the most strenuous efforts will be exerted to prevent the fouling of warehouses and transport and the grave consequential risk of respread of infestation throughout the industrial and commercial premises of the country.

Infestation consciousness may be a high dividend earner for the warehousekeeper, who can count on expert service in Prevention and Disinfestation.

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New Tanker Cleaning Installation

Plant Opened at North Shields

The Tyne Tanker Cleaning Company Ltd. has recently completed the construction of a cleaning station at Northumberland Dock, North Shields. This installation will enable tankers coming to Tyneside for repair to dispose of their oil sludge and residues at the new plant instead of having to discharge them at sea.

The new enterprise is a joint venture by the leading Tyne ship-repairing firms who have long specialised in tanker work, namely Smith's Dock Company, Ltd.; Swan, Hunter and Wigham Richardson, Ltd., and the associated company, Wallsend Slipway and Engineering Co. Ltd.; Middle Docks and Engineering Co. Ltd.; Palmers Hebburn Company, Ltd.; Hawthorn, Leslie (Shipbuilders), Ltd.; Brigham and Cowan, Ltd.; and John Readhead and Sons, Ltd.

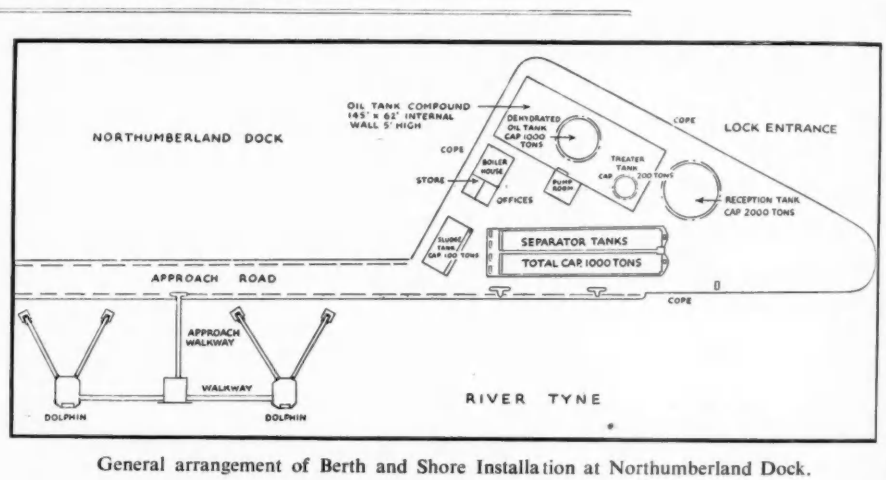
The installation provides continuous facilities for the reception and treatment of contaminated ballast, tank washings and oily sludge and the gas-freeing of tankers. It was designed after close consultation with the Ministry of Transport, technical representatives of the major British oil companies and tanker-owning firms.

A newly constructed deep-water berth, provided by the Tyne Improvement Commission adjoins the installation. This berth is situated within the first towage and pilotage stages of the River Tyne, and is capable of accommodating the largest tankers using the port. The new oil cleaning plant consists of two reinforced separators of a type used in modern refineries, fitted with electrically-operated automatic skimming apparatus, and each with an output of 500 tons per hour. The handling of ballast and tank washings can therefore reach a maximum of 1,000 tons per hour, this total being limited only by the pumping capacity of the ships using the installation. Alongside the separators is a 2,000-ton capacity reception tank for tank washings and oily sludge. There are further tanks for the treatment and dehydration of the oily sludge, contaminated solid materials and for oil storage purposes. All these tanks are fitted with adequate heating coil arrangements for their individual uses.

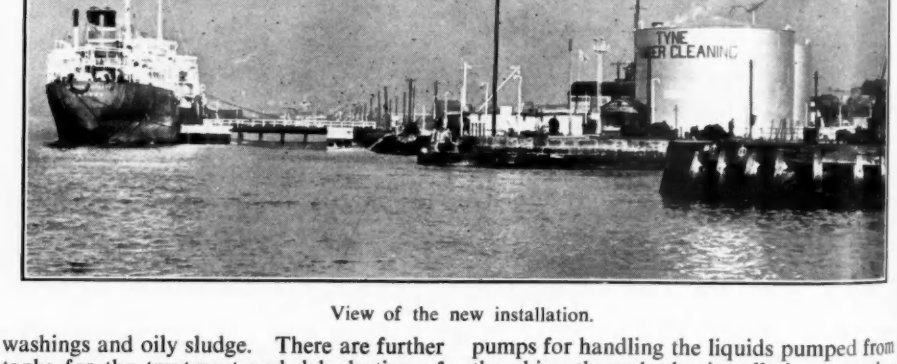
Two Scotch boilers provide steam for the installation and can also supply steam to vessels where required.

A comprehensive pipeline system is provided, with the necessary pumphouse and pumps for handling the liquids pumped from the ships through the installation, together with fresh water, salt water ballast and steam lines. The safety arrangements are fully adequate and all necessary fire-fighting appliances are available.

In addition to these shore facilities, Pyrate tank washing machines for use on board vessels, and labour for attending on moorings, windsails and the necessary cleaning operations on board ship are also available.



General arrangement of Berth and Shore Installation at Northumberland Dock.



View of the new installation.

Inland Waterways—Pollution and Ancillary Matters

Review of Paper at Royal Sanitary Institnte

IN a paper delivered at a Sessional Meeting of the Royal Sanitary Institute in London in February, 1955 Mr. Christopher Lofthouse, A.M.I.C.E. of British Waterways (N.E. Division) surveyed some of the problems and responsibilities which face authorities controlling waterways used for inland navigation. His paper formed part of a meeting devoted to the Hygienic and Welfare Aspects of Waterway Transport, under the chairmanship of Dr. J. A. Scott, O.B.E., Member of the Institute's Council. The papers and discussion of the meeting is fully reported in the Royal Sanitary Institute Journal, vol. 75, No. 5, May, 1955.

The author explained that most commercially navigable waterways are now under the jurisdiction of the Brtish Transport Commission; for many years the navigation authorities, usually canal companies, were the chief guardians of the waterways, responsible for their cleanliness in the interests of those who earned their livelihood on them and of those who lived in their neighbourhood. Recently however River Boards have been granted greater powers in regard to pollution, especially where canal water flows into rivers, as is so often the case. The author emphasised that waterways authorities were sensible of their responsibilities in regard to pollution and that adequate maintenance for navigation purposes plays an important part in any effort to prevent pollution.

Acts and Bye Laws

Under the original Acts and Bye Laws of navigation and canal authorities, various powers were granted to prevent pollution and to deal with obstruction of waterways. In addition, the Oil in Navigable Waters Act, 1922, prohibits the discharge of oily matter and makes other regulations. In addition to these acts, reviewed in the paper, the impact of two further acts on navigation authorities is explained; these are The Water Act, 1945 and The Rivers (Prevention of Pollution) Act, 1951. In view of the fact that the activities of water undertakings (whose interest is the abstraction of water from natural water sources) may have the effect of reducing the supply in navigable channels, and since the new River Boards now have extensive powers within their catchment area, the parts of Mr. Lofthouse's paper dealing with these acts are of particular interest and value, and they are here reproduced:

The Water Act, 1945

" The Water Act, 1945, is one which makes provision for the conservation and use of water resources, for water supplies and for purposes connected therewith, and states that Water Undertakers may make byelaws for preventing pollution of their water, but must not make any byelaw restricting the rights of a navigation authority under any enactment. It also states that, in assessing the quantity of compensation water to be provided, or in determining the extent to which and the circumstances in which water may be taken, the Minister shall have regard to all the circumstances of the particular case, including:

(a) the character and flow of the stream;
(b) the extent to which the stream is or may in the future be used for industrial purposes, fisheries, water supply by other undertakers, agriculture, transport or navigation; and
(c) the effect on land drainage or on any canal or inland navigation of any alteration in the flow of the stream,

and shall ensure, as far as is practicable, that the flow of the stream does not fall below the minimum quantity necessary to secure the interests of public health and the protection of the rights of riparian owners and other landowners.

It is one of the chief duties of a navigation authority to investigate proposals for the abstraction of water in order to safeguard the amount of water necessary to maintain the navigation on an effected river or canal, particularly during periods of drought. The fact of safeguarding an amount of water or obtaining adequate compensation water also safeguards an amount of fresh water affecting dilution of sewage effluents. It may be that the water is abstracted and returned as sewage effluent to the stream at a point above the navigable length so that, although navigation does not suffer a lack of water, the water is in a more polluted condition."

Rivers (Prevention of Pollution) Act, 1951

" This act made a new provision for maintaining or restoring the wholesomeness of the rivers and other inland or coastal waters of England and Wales. Under this act, a person commits an offence if he permits polluting matter to enter a stream or impedes the proper flow of a stream and aggravates the pollution. The prohibition of the use or proposed use of a vessel in a defective state of repair for the carriage of cargoes from which poisonous, noxious or polluting matter may enter the stream is given specifically under the act.

It is also an offence to move deposits from the river bed upstream of any dam, weir or sluice without the river board's consent, through the deposits being brought into suspension in the water and carried away by sluicing, but this does not apply to anything done in exercise of statutory powers granted for land drainage, flood prevention or navigation.

A river board may, by byelaws, make provision for prescribing standards for determining when matter is to be considered as polluting; for controlling the deposit of litter and other objects in a stream whether polluting or not, and for prohibiting or regulating the keeping or use on the stream of vessels provided with sanitary appliances from which polluting matter passes or can pass into the stream.

It is noted that matter can be considered as poisonous or noxious or polluting by reason of its temperature or by reason of its effect in discolouring a stream.

All new or altered outlets for the discharge of trade or sewage effluent or new discharges must be approved by the river board.

There are numerous industrial firms who have agreements with the British Transport Commission to take water from the British Waterways' canals for use in their processes. It is now the rule for the user to obtain a consent from the river board for new or altered outlets or new discharges before an agreement is entered into. The agreement states that the users shall at all times conform to the requirements of the Commission and the appropriate river board, and all water returned to the waterway shall be of such standard of purity and temperature as may from time to time be imposed whether by such board or by the Commission.

In the schedule attached to the agreement, the estimated quantity of water abstracted and the quantity returned have to be specified, and the users have to state whether the water returned will be free from solid substances, acids or any noxious matter and also the temperature of the water."

Cleansing and Scouring

The primary object of dredging is, of course, to maintain an adequate depth of water for navigation, and this is accomplished by bucket, grab and suction dredgers, and by spoon dredgers in restricted places. The author remarked that often the material dredged can be considered as being of a polluting nature, for example coal dust, certain vegetation and sludges. The waterway authorities will normally require that any discharges into the channel shall pass through settling tanks if otherwise serious silting would occur. Dredging and cleansing also extends to feeders and reservoirs and weeds have to be cut periodically. Although primarily carried out for navigation purposes, this cleansing and dredging provides a better flow of water and thus contributes materially towards an improved dilution of sewage and other pollution; furthermore the regular use of canals by traffic itself helps to maintain the channel, which is a further justification for concern in cases where canal traffic is declining.

Inland Waterways—continued

Co-operation with River Boards is also effective over such matters as gauging of flow at weirs and over measures for flood prevention.

Condition of Navigable Rivers

Annoyances due to the increased abstraction of water, increases in sewage effluents and water temperature and more varied industrial effluents have increased in recent years, as the author explained."

" One river board reports that much still remains to be done on prevention of pollution by sewage before even the most urgent needs are satisfied. This board calls attention to the need for a more generous allocation of public funds for the financing of schemes of sewerage and sewage disposal, and states that, without better facilities in this connection, it will be impossible for any real progress to be made and that it may even prove difficult to prevent the deterioration of existing conditions.

Another river board states that of the 500 miles of its main river and 10 prinicpal tributaries, less than 100 miles can be classified as clean within the chemical standards put forward by the Royal Commission on Sewage Disposal. However, a further 250 miles of these waters are in fact found to be reasonably habitable by fish, but the remaining 150 miles are rendered by pollution quite unusable by either industrial or recreational interests.

It is calculated that the sewage and industrial wastes discharged to the surface waters in the watershed amount to about 200 million gallons per day, whilst the maximum flow of the main river for a large part of the summer and autumn of each year totals 500 million gallons per day. Even if all these wastes had been purified to the accepted Royal Commission standard, they still, in view of the limited dilution by " clean " river water, place a heavy load on the river for purification under natural conditions.

The Port of London Authority are gravely concerned at the present condition of the water in the Thames, which shows no sign of altering its progressive deterioration despite various schemes which are in hand for improving the condition of effluents discharging into the river. Sewage and industrial effluents in addition to hot flue gas washings from power stations are making demands on the oxygen content of the river water to such an extent that a state of complete deoxygenation occurs at times from Erith upriver to Batteresa. The flue gas washing effluent is discharged as a nearly saturated solution of calcium sulphate, and it is stated that the system could not be used to any greater extent on the Thames.

Six borough councils are pressing for more urgent treatment of the problem, whilst it is reported that underwater planking of vessels is rotting at an unprecedented rate due to acids and deleterious matter in the water and in the mud of the foreshores. Owners of large vessels are complaining that it is difficult to find a paint which will withstand the effects of gases which emanate from the polluted water.

The similar condition of most industrial rivers appears to be mainly due to inadequate sewage treatment, the increase of industrial effluents, and the heating of the water through power stations.

There are schemes in hand for improved purification of sewage, but the increase in the number or the capacity of power stations constitutes a major problem to rivers and canals, even from a navigation point of view."

Power Stations.

From the point of view of encouraging waterborne traffic, the siting of power stations alongside navigable rivers and canals is highly desirable. There are, however, some serious difficulties arising from the use of the river or canal water for cooling purposes in the power station and extracts from this paper quoted below, in which the author outlines the results of some investigations by the British Transport Commission will be of interest. It is most important that these difficulties should be overcome, so that the navigation authority, anxious for waterborne traffc, can offer cooling water facilities as an inducement for siting power stations and other industrial enterprises requiring cooling water alongside. It must be realised that the temperatures of water used in a power station may be increased by as much as 14°F. before it is returned to the river, downstream, or to some other part of the canal, so planned that there is not an excessive rise in the temperature of the cooling water at the point where it is abstracted. Power station performance is very sensitive to cooling water temperature, and the overall efficiency of a power station (and hence fuel consumption for a given electrical power output) can be adversely affected by some 2½% through a 10°F. rise in the temperature of water supply. Apart from this difficulty, especially where cooling water is taken from a length of canal, in ensuring that the temperature of the water supply is not adversely affected, the rise in temperature in the waterway is likely to have adverse affects on other riparian users and on navigation due to fog and even causes deterioration in engine performance of motor driven vessels. One solution lies in the introduction of cooling towers, but these involve considerable capital expenditure and to some extent nullify the attraction of siting the station beside the waterway. Even with cooling towers, the water will not be cooled to the temperature of the waterway; indeed if it could be, the attraction of so siting the station would disappear. There is also a loss of water in the cooling tower, which is usually estimated at 1%, but is often greater, the value of which must be considered in entertaining any proposition, especially if water is scarce, as may be the case in a canal.

The author outined the results of some investigations carried out by the British Transport Commission as follows:—

" One power station wished to circulate cooling water in an impounded stretch of river and through a length of canal by pumping water from the river to flow along the canal and spill back to the river near the intake.

In order to augment water supplies, the sewage effluent from a city was also to be taken in to the station. It was therefore necessary to ascertain the effect of heated water containing sewage effluent

(1) on the canal, with regard to the bacteriological action causing offensive smell and the growth of organisms, thus necessitating frequent cleansing;
(2) on iron, steel, timber, etc.
(3) on firms using canal water for industrial purposes: and
(4) the effect of chlorination of the sewage effluent at the power station.

Four examples, each in a winchester quart glass stoppered bottle, were obtained by dipping over a period of four hours and were despatched for analysis and report:

No. 1 sample, as shown in Table I, was of river water upstream of sewage outfall;

No. 2 sample of sewage effluent from outlet channel;

No. 3 consisted of river water downstream of sewage outfall: and

No. 4 sample was canal water.

Table I

Analytical returns	Parts per 100,000			
	No. 1.	No. 2.	No. 3.	No. 4.
Suspended matter	0.8	5.8	3.8	7.8
Combined chlorine	5.3	12.8	8.5	5.7
Total hardness	—	—	17.0	16.0
Temporary hardness	—	—	9.5	10.5
Permanent hardness	—	—	7.5	5.5
Ammoniacal nitrogen	0.6	0.75	0.7	0.6
Albuminoid nitrogen ...	0.08	0.24	0.16	0.12
Nitrous nitrogen (nitrites) ...	trace	heavy trace	trace	trace
Nitric nitrogen (nitrates) ...	0.04	1.3	0.55	0.03
Oxygen absorbed in 4 hrs. at 26.7° C.	1.34	2.75	2.15	2.26
Bio-chemical oxygen demand ...	1.59	2.02	2.06	1.15
Behaviour on incubation ...	stable	stable	stable	stable

No. 2 was found to be a satisfactorily purified and stable sewage effluent, which naturally increases the amount of fermentable organic matter in the river water (No. 1) which has already been subject to a sensible amount of contamination. The sewage effluent contributes an appreciable amount of nitrate to the river water, which may be accepted as a potential oxidizing agent.

The organic quality of the canal water (No. 4) is sensibly worse than that of the river water (No. 1) upstream of the sewage effluent outfall, and apart from its biochemical oxygen demand, very little

Inland Waterways—continued

better than the river water (No. 3) downstream from the outfall. The queries were answered as follows:—

1. With adequate chlorination of the sewage effluent, there would be no increase in the bacterial action causing offensive smells in the canal. Vegetative growths might necessitate more frequent cleansing of the canal by dredging operations.

2. There would not be any detrimental effect on iron, steel, timber or masonry.

3. From an analytical standpoint there is nothing to suggest any sensibly dertrimental effect as far as industrial use of canal water is concerned, except where the water is used for cooling purposes. In such cases, there is every possibility of a prejudical effect, by the raising of the temperature of the canal water.

4. The degree of chlorination at the station would be designed to obviate the development of fungoid growths in the condensers, and care would be taken to see that it was not sufficient to damage the condenser tubes.

In addition to the above there is another factor which cannot be ignored, namely, the possibility of the formation of heavy mist or fog in the vicinity of the canal which might be caused by the regular inflow of water at a temperature of 80°F. or higher during the colder weather when the atmospheric temperature is much below that of the canal water.

As a result of the investigations, an agreement was entered into which included the following clauses relating to the water to be pumped into the canal and circulated along it:

The biochemical oxygen demand thereof shall not exceed 2.5 parts per 100,000 and the amount of suspended solids shall not exceed 5.0 parts per 100,000.

The amount of residual (free) chlorine shall not average more than 0.2 parts per million and shall not at any time exceed 0.4 parts per million.

The cost of any additional dredging required would be borne by the authority.

The question of the prevention of fog formation was considered to be a vital matter to navigation, and as a result the temperature of the water entering the canal was limited as follows:

The maximum permissible temperature of water pumped into the canal shall be:

65°F. during the months of January, February and December.
70°F. during the months of March, April and November.
80°F. during the months of May, June and October.
85°F. during the months of July, August and September.

It must be observed that conditions for using a canal as a cooling circuit can more readily be laid down than in the case of a river where British Waterways have only the navigational rights.

There is the problem of proving at an inquiry that the heated river water will accentuate the density of fog to such a degree that vessels will find difficulty in navigating. There is also the question as to the effect of the heated water on industrial users situated downstream of the power station. The latter question was investigated by means of a thermo-hydraulic model constructed and operated by the Research department of the Docks and Inland Waterways, temperature decrement curves being obtained.

An inquiry into the proposed power station on a navigable river resulted in the application of the following conditions with regard to temperature:

The water discharged shall not heat the river water below the station to a temperature in excess of 90°F. or to a temperature more than 20°F. greater than the temperature of the water above the station, whichever of these temperatures is the less.

In another case agreed between British Waterways and the Authority, the water had not to be heated more than 10°F. above the temperature of the river water at half a mile upstream from the river cooling circuit.

The problem that is now apparent is not the detrimental effect of one power station but the cumulative effect of a number of power stations on the river. Existing stations are being doubled and new stations are proposed of greater capacity. One proposed station requires 1,200 million gallons of water per day for direct cooling from a tidal stretch of a river. Cooling towers would be used at neap tide and low flow periods, and under that system, approximately 7.5 m.g.d. would be lost to the river.

This cumulative effect on rivers can be shown by reference to a river upon which millowners formed an association in 1927 for the purpose of taking steps to watch and obtain the discharge of compensation water in order to safeguard the millowner riparian owner. Many of the 57 members take water from artificial cuts owned by the British Transport Commission. The water safeguarded amounts to 19.25 million gallons per day, and the contemplated loss of 6.25 million gallons per day through existing and proposed cooling water towers at power stations amounts to 32 per cent. of the water safeguarded. This loss, combined with a temperature rise in the water, would affect the processing of materials by the millowners and affect the amount of water available for navigation during periods of drought and, of course, affect the dilution of sewage effluents. The minimum flow of the river was 30 m.g.d. over three months of 1950.

Another river, having a minimum flow of 70 m.g.d., will lose 11.6 per cent. of that flow after the completion of new power stations, whilst further upstream where the lowest recorded flow was 33 m.g.d., the eventual loss will exceed 22 per cent. of that amount."

Conclusions

The author emphasised that River Boards are now the chief guardians of watercourses in matters of pollution, but that the Waterways Division of the British Transport Commission have always been happy to co-operate. Fortunately there are many interests in common, one of the more important aspects of which is that maintenance of a canal or navigable river to high standards for navigation, and its extensive use for traffic, has beneficial effects upon pollution.

The fact that a Sessional Meeting of the Royal Sanitary Institute has been devoted to matters of Hygiene concerned with Inland Waterways is extremely gratifying, in view of the eminence of this Institute. Acknowledgment is gladly recorded for permission to review this paper and to publish extracts of particular interest. It is hoped to report and comment upon the other two papers of the Sessional Meeting in later issues of the "Dock and Harbour Authority."

Tanker Dry Docks at Penzance

The ss. Pass of Melfort which is owned by the Bulk Oil Steamship Co. Ltd., London, recently docked at Penzance for general overhaul, painting and boiler cleaning. She carries about 750 tons of petrol, and trades along all coasts of the British Isles and occasionally to the Continent. This is the first time a tanker has ever been dry docked in Penzance and it is hoped the innovation may mean the beginning of a new trade to the town.

Pier Extension at Port of Melbourne

Ingenious Caisson Foundation Method

The extension of Breakwater Pier, Williamstown, by the sinking of two 2,500-ton reinforced concrete caissons at the end of the pier was advanced towards the final stage last March, when one of the caissons was towed into position and sunk.

To meet the requirements of the Standard-Vacuum Oil Company's £20,000,000 refining plant at Altona, three miles away, the Melbourne Harbour Trust Commissioners decided to restore and extend Breakwater Pier, which had not been in use for about a quarter of a century.

Besides restoring and extending the pier, the Trust carried out land reclamation work which has provided the site for two crude oil transit tanks and a bunker oil tank between Breakwater and Gellibrand Piers.

This latest undertaking by the Trust will enable the Standard-Vacuum Company to enjoy facilities appropriate for the vast expansion of an industry that will contribute considerably to the further prosperity of the State of Victoria.

The 2,500-ton caisson placed in position at the end of Breakwater Pier was partially constructed in the Royal Australian Navy's floating dock alongside Gellibrand Pier and partially outside the dock, alongside the pier. This conforms with the Trust's general pattern of following the efficient, modern practice of off-site pre-construction.

To extend the pier, Trust engineers decided to sink two reinforced concrete caissons, each 81-ft. long, 35-ft. wide and 54-ft. deep. After being towed to the site and sunk off the outer end of the pier, the caissons are secured on timber piles and filled in with granular material. Filled in, their weight approximates 4,000 tons.

Preliminary Dredging.

On the site, the sea bed consists of a basalt shelf running out from the shore and dropping steeply to a stiff clay bottom. Off the outer end of the pier this clay again falls to 80-ft. below water into a deep, silted channel, originally the old course of the River Yarra.

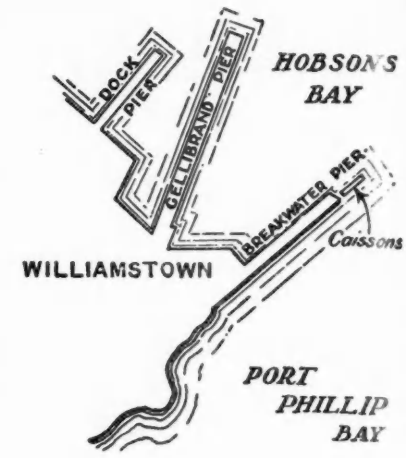
Because of the depth here, continuation of the rubble breakwater was impracticable, so it was decided to construct the extension by resting two reinforced concrete caissons on timber raking piles.

Dredging of the berth and swinging basin was carried out and an area of 3,500 square yards was dredged at the end of the pier to a depth of 60-ft. below low water level to accommodate a sand mattress foundation for the caissons.

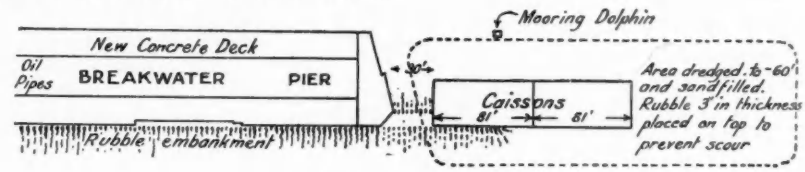
The sand mattress was built up to a thickness of 16-ft. and after both caissons have been placed in position it will be covered with 3-ft. of rubble to prevent scouring.

Caisson Construction.

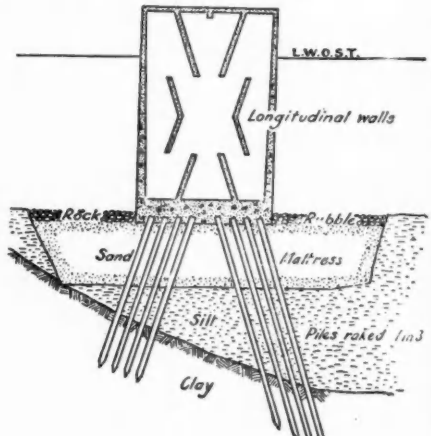
The caisson now in position at the outer end of the pier was first laid down in the R.A.N. 1,000-ton floating dock at Williamstown. It is basically a reinforced concrete box, the floor being divided into bays by 12 transverse floor beams and a longitudinal beam along the centre line.



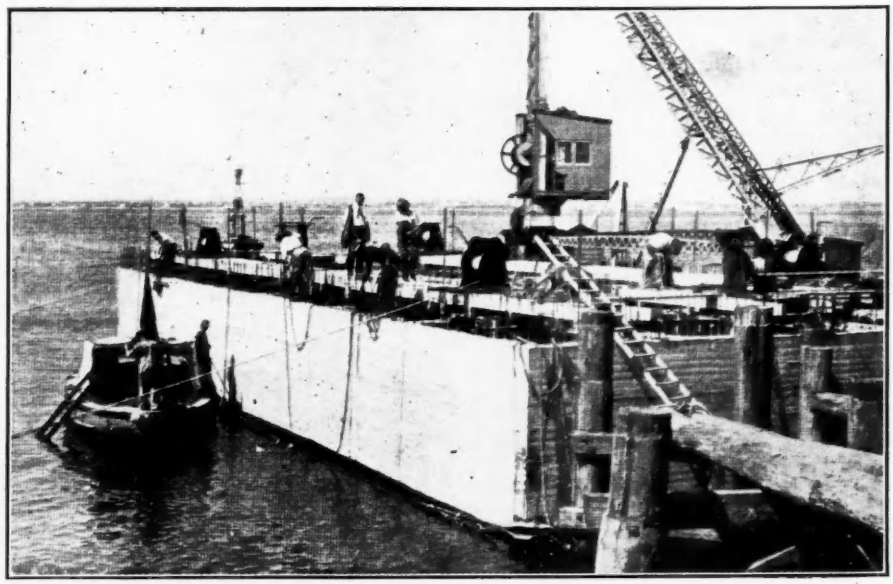
General Lay-out at Breakwater Pier.



Caisson area enlarged.



Cross-section of caisson, showing piling, longitudinal walls and concrete plug placed.



Caisson floating in position at site, prior to sinking.

Between the beams is a 4-in. reinforced floor into which is cast 2-ft. diameter oregon tapered plugs which are sealed against the entry of water. These plugs are knocked out by the toes of the piles, when driven in at the final stages.

Five internal transverse stiffening walls are provided with a nib cast 2-ft. from the floor. This, together with hooked rods cast into the floor beams, serves as a key for the 5-ft. thick concrete plug later to be placed to secure the caissons to the heads of the piles.

Monorail Transporter.

To provide a level floor for working in the dock, a hardwood floor was constructed on 12-in. by 12-in. hardwood bearers. Loaded Monorail transporter cars moved around the job as required, tipping on to

Pier Extension at Port of Melbourne—continued

platforms from which the concrete was spaded into forms and consolidated by pneumatic internal vibrators.

Each lift of 2-ft. 8-in. was treated as an individual job, with independent instructions and diagrams. The work in the dock was carried out progressively to a height of 16-ft., the buoyancy of the structures being used to relieve the dock of the load.

The caisson had a freeboard of 4-ft. when construction had reached a height of 16-ft. The dock was then lowered to give 2-ft. of water clear below the caisson floor and the structure was then towed to Gellibrand Pier and moored alongside. Further construction was carried out at the pier to within 6-ft. of the top.

Caisson Held Fast.

Having been sunk to the sand mat off the end of Breakwater Pier, after a tow of about 800 yards, the caisson was given permanent support by 144 timber piles, the heads of which were embedded in the 5-ft. thick concrete plug. The piles, at a rake of 1 in 3, varied in length from 40 to 60-ft. and were driven between the longitudinal walls of the caisson, which had been designed, as indicated in the figure, for this to be done. The toes of the piles were positioned, by divers, over the centres of the oregon timber plugs that had been cast in position in the concrete floor.

The final stage of the completion of the extension was the construction of another 6-ft. to the walls of the caisson and filling in and placing of a 9-in. reinforced concrete surface slab. The caissons will be connected to the wharf by a 5-ft. wide walkway.

Other work carried out to fit the 100-year-old Breakwater Pier for its new role as a berth for tankers include refacing the west side and redecking it with two bays of 40-ft. by 10-ft. pre-cast reinforced concrete slabs.

The berth has already been dredged to 40-ft. to provide for tankers with up to 35-ft. draft.

Prime Minister Opens Refinery.

On 4th April, the Prime Minister, Mr. Menzies, officially opened the Standard-Vacuum Company's refinery at Altona. Because oils and derivatives are the largest individual import to Melbourne, the operations of the plant at Altona are of vital interest to the State of Victoria.

With the completion of the new tanker berthage at Breakwater Pier, crude oil will be discharged in large quantities annually from tankers from Dutch New Guinea, the Middle East and Venezuela.

When in full operation, the plant will handle 700,000 gallons of petrol and other products daily for distribution throughout Australia. Eventually 500 men will be employed in this enterprise. Products will include jet fuels, gasoline and diesel bunker oils.

The first shipment of products of the Altona plant for export interstate will soon leave the Port of Melbourne.

This trade from Melbourne is expected to expand rapidly in forthcoming months.

Another chapter has been begun in the development of the Port of Melbourne and the expansion of basic secondary industries so essential to the well-being of an enterprising State.

London General Shipowners' Society

Various Topics in Annual Report

The Annual Report of the London General Shipowners' Society, which was presented at the recent Annual Meeting, included the following items of general interest.

Fire Prevention Problems.

The subject of fire prevention and fire fighting in ships in port has been under consideration by the Port of London Authority in conjunction with the London Fire Brigade. A series of exercises were arranged in which shipowners were asked to co-operate. The Fire Brigade undertake to train shipowners' fire patrol men and it is understood some members have taken advantage of this facility.

The main point stressed by the Fire Brigade was that early notification of any signs of fire, however small, was essential, and to ensure this the P.L.A. will issue to masters of all vessels entering the docks a notice giving them particulars of what action to take and the position of the nearest telephone.

The position of a vessel anchored in the river or in the middle of a dock, without shore communication, presents a difficulty. The P.L.A. suggested that the continuous of the ship's bell should be used to give the alarm in the event of a fire. In view of the regulations for ringing ship's bells during fog, etc., this it was felt might lead to confusion and, therefore, in the absence of any other means of communication with the land, resort will be made to the ship's wireless in such cases.

Further discussions are in progress between shipowners, ship repairers and the P.L.A. regarding the application for and issue of licences for repair work on ships in dock where fire risks are involved.

Quay and Shed Agreements.

With the completion of the repairs to war damage in the King George V Dock, the P.L.A. re-introduced the pre-war practice of appropriating berths to liner companies regularly using that dock. After discussion and correspondence a new form of agreement was drawn up to cover berths in this dock and will, it is intended, form the basis of future agreements in other dock areas as and when repairs are completed and the full complement of berths becomes available.

Flood Defences—River Thames.

Following on the report of the Departmental Committee on Coastal Flooding, a technical panel has been formed by the Ministry of Housing and Local Government to study the feasibility of constructing some form of barrage across the River Thames to combat excessive flooding in the more populated areas. Shipowners have been consulted, but have refrained from expressing any opinion in favour of or against any such project until some concrete proposal is put forward which can be studied in all its aspects.

Oil Pollution.

As envisaged in the last annual report, this country has accepted the 1954 International Convention. Among other requirements the International Convention provides for the carriage of an oil record book on all vessels to which the Convention applies. Although this may not be compulsory for some months it is hoped the members will in fact carry out this requirement, as from these records it may be possible to assess the amount of oily waste and sludge which has to be disposed of annually and so give some indication to the Port of London Authority as to what facilities will be necessary in the port should the total abolition of discharge into the sea become compulsory. Members will be asked to supply the necesasry data in due course.

Rising U.K. Port Costs.

Speaking at the meeting, the retiring chairman, Mr. Kenneth R. Pelly, referred to increasing dock charges and general costs. He pointed out that shipowners knew only too well that their own costs had continued to rise in wages, replacements, repairs and all the various other matters which went towards the cost of shipowning. The dock authorities and those who work within the area of the docks were faced with the same increases. Shipowning was a very competitive business and dock authorities were to a greater or lesser degree placed in th same position and must be competitive with large near-Continental ports which in some cases were destroyed by enemy action during the war and were now equipped with the most modern and up-to-date labour-saving appliances. As a member of the Port of London Authority, he saw the position U.K. ports were faced with and realised that they were fully alive to the effect of competition. They had largely completed their war damage repairs and were now spending immense sums of money in modernising, improving and mechanising their docks. At present he could not see the end of this continuing rise in costs, but if the peak was not somewhere near, the country would find itself out of competition with its rivals with the inevitable results on its export trade.

Record Season for Port Churchill

Report on the Hudson Bay Route

The Fourteenth Report of the Commonwealth Shipping Committee on Hudson Bay Marine Insurance Rates 1955, which describes conditions affecting ships trading to Port Churchill during the 1954 season has recently been published (H.M. Stationery Office. Price 1s. nett).

After stating that the report is published annually to enable underwriters in London to appreciate the physical circumstances as they gradually become better known and to enable those in Canada interested in the route to appreciate the factors which had to be taken into account in London before a rate could be quoted, the report proceeds with the 1954 season.

A total of 36 ships made commercial voyages to Port Churchill last year, five more than the previous year's record. Despite a record shipment of 12,485,000 bushels of grain—1,700,000 bushels higher than in 1950—there was no evidence of congestion

Faster Shipping Turn-Round.

Shipping statistics "compare most favourably in every respect with those of 1953," the report continues. Shipping occupancy of the port totalled 128 days (172 in 1953) and turn-round times for all ships averaged 3.6 days (5.6 in 1953). In 1954, 33 ships were turned around in 5 days or less, including 23 in 3 days or less (19 and 8 respectively in 1953). During the season and up to October 10 the port was empty of shipping for a total of 18 days (8 in 1953), including 8 consecutive days from August 31 to September 7. There were two ships with inward cargo in 1953 and three such ships in 1954. "One shipowner with considerable experience of the Hudson Bay route informed us that the turn-round of ships in Churchill has continued to be good and the port was given a real test in September when it coped with all it was asked to do." Between September 8 and October 7, 22 ships entered, loaded in, and sailed from, Port Churchill, including one which discharged inward cargo.

Among the chief reasons for this speedier handling of ships was that the much better deliveries of grain ensured that there was always sufficient in store to complete cargoes as the ships arrived. Another factor was that in 1954 the grain arrived at the port in good condition, and it was not necessary to resort to artificial drying before shipment, as had been the case in respect of considerable quantities shipped during the 1953 season. The stevedores also were much more efficient in operating the mechanical trimmers as they had profited by the experience of these machines gained in 1953.

Navigation Period.

There was no alteration in the marine insurance rates or in the permitted period of navigation, which again extended from July 23, passing Cape Chidley, to October 10, leaving Churchill.

The first ship in was given permission to enter the Hudson Strait on July 23, and the last vessel out left Churchill on October 7.

The port could have been used by commercial shipping up to October 15 (a percentage surcharge on the additional premiums being payable for vessels using the port between October 10 and 15), and the fact that no commercial vessels used the port after October 7 was in no way due to adverse navigational conditions.

Reports from the masters of vesels using the route at the beginning of the season indicate that the usual conditions of fog and ice were encountered. The earlier vessels on the inward passage met with stretches of field ice, some of which had to be traversed and which caused in a few cases slight damage to plates or propeller blades, but on their homeward passage through Hudson Bay and Strait they found the route free from field ice.

One vessel, however, was involved in a collision with an iceberg after she had left the Hudson Strait on her homeward voyage. This ship, the motorship Anna C, developed a defect in her radar set on her arrival in Churchill, and it was not possible for the set to be repaired there. This is the only casualty for many years which has resulted in a vessel on the Hudson Bay route sustaining more than superficial damage.

Ice Hold-up Unlikely.

In their last three reports, the committee have remarked that the possibility of a ship being caught by ice in the Hudson Bay or Strait after departure from Churchill at the end of the season must be regarded as a remote one. They stated that the Churchill river froze first and that the freezing up gradually extended to the bay and, finally, to the strait. Data reproduced showed that over a number of years, ice had not appeared at Port Churchill until late October or early November and that its appearance was progressively later at Nottingham Island, Cape Hopes Advance, and Resolution Island.

In 1954, the dates on which ice was first reported at these four places were as follows: Port Churchill, October 30; Nottingham Island, November 6; Cape Hopes Advance, November 18; Resolution Island, December 3.

It appears from the evidence accumulated over a number of years that the navigational hazards of the route are generally much lighter at the end of the season, and apparently for some time after the close of the season, than they are at the beginning.

The view is also expressed that, having regard to the keen co-operation of the Canadian authorities in the provision of facilities for the safety of ships voyaging to Churchill, the steps taken by shipowners to promote the safety of their ships by the installation of gyro compasses, direction finding and radar equipment, and the long record of successful voyages to the port, the route bears favourable comparison with the St. Lawrence route.

Aerial surveys were made of ice conditions in the Hudson Bay, and the resulting information was available to masters of vessels navigating the waters, together with reports of surface observations collected from Port Churchill and the coast stations. These reports were also transmitted to London and forwarded to the shipping Press for publication. The masters of several ships made suggestions for the improvement of navigational aids in the Hudson Bay and Strait areas, and it is understood that the Canadian authorities will give attention to these suggestions.

Potential Increase in Trade.

The Committee state that they were informed by a shipowner who consistently engages his vessels in this trade that, in his opinion, if a reduction in the marine insurance rates applicable to vessels trading to Churchill could be achieved, the trade would become much more attractive to shipowners, and more trade could be developed through the port.

It also had been brought to the notice of the Committee that there should be good prospects for the shipment of lumber to the United Kingdom through Churchill, which is the only port which might offer Northern Manitoba and Northern Saskatchewan lumber producers the opportunity of marketing their product in the United Kingdom. The annual production of lumber in Manitoba is approximately 60,000,000 f.b.m., and in Saskatchewan approximately 75,000,000 f.b.m. The great bulk of the production of both provinces is spruce and there are substantial stands of aspen which might be shipped in log form for use in the match and veneer industries. There have been one or two lumber shipments out of Churchill since the Second World War, but the port has not been used for this traffic in recent years because of the costs which make such shipments economically unattractive.

It has been suggested that, with some encouragement and a reasonable chance to compete on an equal basis, lumber shipments through Churchill could be developed. The committee are interested in this suggestion and will investigate it with a view to reporting more fully on the subject in their next report on Hudson Bay.

The report concludes with an additional note by the chairman, stating that an advance copy was forwarded to the Joint Hull Committee in order that the facts might be taken into consideration by them when reviewing the position for the new season. The note states that the chairman had been informed that the Joint Hull Sub-Committee have approved an amendment to the Hudson Bay scale of additional premiums to the extent of permitting a vessel to leave the last loading port on or before, but not later than, October 15, with a proviso that extensions up to October 20 can be agreed at scale rates surcharged by 25 per cent.

The Lower Sind Barrage at Kotri

Important Contribution to Pakistan Irrigation

An engineering work of great importance to the economy of Pakistan has recently been completed by the opening in March 1955 of the Kotri Barrage across the Indus near Hyderabad.

The purpose of the Barrage is to control the flow of the River Indus, while preserving navigation, and to irrigate over 2.7 million acres of land hitherto unproductive.

The main Barrage is approximately 3,000 feet long, and is fitted with 43 sluice gates, and a navigation lock. The sluice gates are designed to pass a maximum flood of 875,000 cusecs. The maximum head between upstream and downstream sides of the Barrage in the cold weather will be 31 feet.

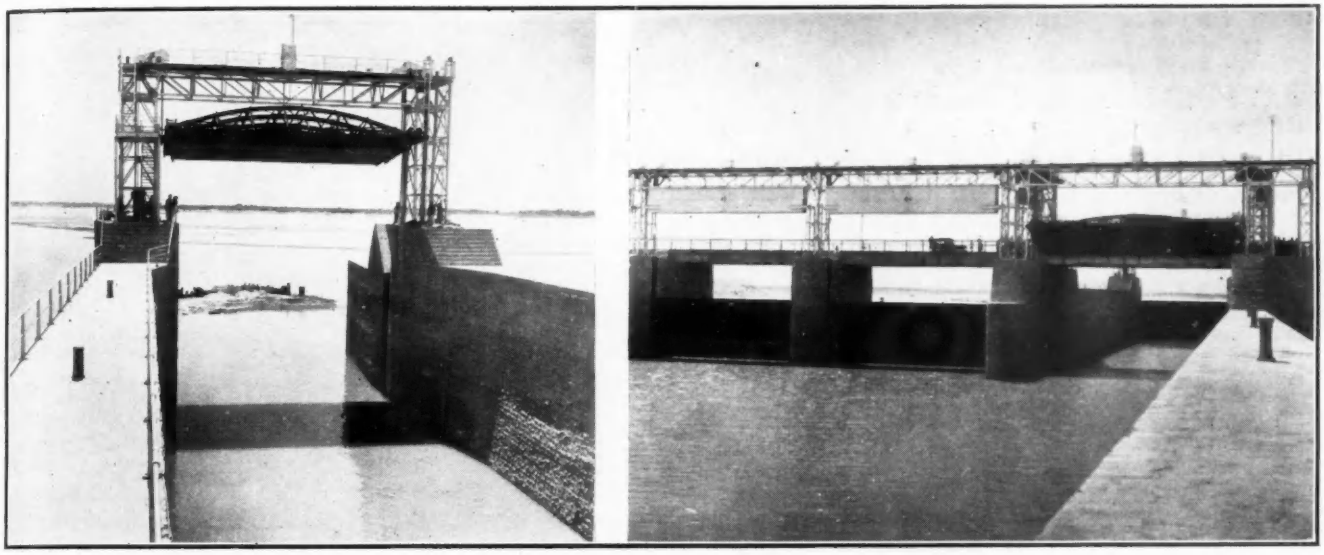
General Construction.

The main construction work was carried out by Pakistani engineers, small constractors, and direct labour under the overall supervision of a British Chief Engineer, assisted by a few other British engineers whose services were mainly in connection with the mechanical side.

The Barrage is made of concrete with stone facings. Its construction has taken just over five years. The sluice and lock gates, steel superstructure and machinery were supplied and installed by Ransomes and Rapier, Ltd., Ipswich, England.

Apart from the benefits to agriculture, the Barrage will enable the water supply of both Hyderabad and Karachi to be substantially increased, and it is intended to flood a series of depressions which will give rise to a lake of over 40 square miles, providing both a reserve of water for Karachi and hydro-electric power.

In view of the dangers of waterlogging which have impaired soil fertility in other parts of Sind and of India, one of the irrigation canals is being lined with cement concrete over a length of 70 miles, with a bed width of 44 feet and a depth of 15½ feet.



(Left) Downstream Roller Lock Gate (in the raised position). (Right) Two of the Barrage Gates and Upstream Roller Lock Gate (being raised) with road bridge at the back.

Each of the 43 sluice gates has a span of 60 feet, a height of 21 feet, and weighs 45 tons. The height of lift of the gates is 34 feet; staunching members are provided at the sides and bottom of each gate, to minimise leakage. Each gate is counterpoised, and arranged for manual raising and lowering from a central crab located on the superstructure. The full operation of raising or lowering is designed to take 90 minutes with two men at the crank handle.

The Lock Gates.

The Navigation Lock is provided with two gates which can both be raised and rotated in order to provide clearance for small craft. The upstream gate has a clear span of opening of 60 feet; the downstream gate opening is 50 feet. The depth of these gates are respectively 21 and 34 feet.

Operation is by electric power, with emergency hand gear. The designed speed of lifting or lowering under power is 1 foot per minute. The upstream gate is powered by a 5 h.p. motor; the downstream gate has a 10 h.p. motor.

The impounded water of the Indus is dealt with at the Barrage by two sets of canal regulator gates, one at each side. There are 17 sluices on the left bank and 6 on the right.

Road Bridge.

The Barrage is provided with a road bridge 20 feet wide with footpaths 4 feet wide on each side. The bridge is carried on prestressed concrete beams; a lift bridge is provided at the lock with a headroom of 15-ft. 6-in. and a lift of the same height.

The Barrage also carries a pipeline bringing natural gas from the North to Karachi, and provision has been made for a high tension power cable to be carried over the Indus, via the Barrage, if required at a future date.

The National Association of Port Employers

Consequent upon the resignation of Mr. D. F. Macdonald, M.A., D.Phil., M.Inst.T., as General Manager of the National Association of Port Employers, Mr. James Morris Gifford, M.A., Barrister-at-Law, has been appointed to the post.

Mr. Macdonald, who has been with the Association since 1943, has been appointed by St. Andrew's University to the Chair of Modern School and Economic History at Queen's College, Dundee.

Mr. Gifford was educated at Dunfermline High School and Edinburgh University. During the war, he served as an officer in the Royal Artillery. Subsequently, he resumed his studies graduating in Classics, and in 1951 was called to the Bar.

Since 1946, Mr. Gifford has been on the staff of the Shipping Federation Ltd., in various ports, including Liverpool and London and is at present Clyde District Secretary of the Federation. For several years as Assistant Secretary, Thames District Shipping Federation Ltd., he devoted a large part of his time to dock labour matters in London.

New Dockmaster for Swansea

The British Transport Commission announce that Captain S. Baxter-Wright, at present dockmaster at Barry, has been appointed dockmaster at Swansea. He takes up his new duties this month, when Captain E. H. Slater retires. Captain Baxter-Wright was appointed dockmaster at Barry in June, 1952, and prior to that he was dockmaster at Port Talbot for two years. He entered the service of the former G.W.R. Company as pier master at Barry Docks in 1929.

Manufacturers' Announcements

Habbaniyah Flood Scheme, Iraq

The final stage of the Habbaniyah Flood Scheme will be reached this year with the completion of the Ramadi Barrage spanning the River Euphrates. The barrage is 209 metres long and includes a navigation lock, a fish ladder and 24 gate openings.

The 24 gates are each of 6 metres span 8 metres deep and the lock gates 6 metres span by 8.5 metres deep; all are electrically operated. There is a double leaf lift bridge spanning the lock.

In addition to the Ramadi Barrage, the Habbaniyah Scheme includes 3 main canal regulators, one at Warrar with 24 gates 6 metres span 7.5 metres deep, one at Mujarah with 8 gates 6 metres span 6.5 metres deep and one at Dhibban with 5 gates 6 metres span 4.7 deep. All these gates, structures and operating machinery have been designed, manufactured and tested by Ransomes and Rapier Limited at their works in Ipswich.

The Habbaniyah Flood Scheme, besides controlling the dangerous flood waters, will also ensure the irrigation for agriculture of large areas of what was previously desert land.

Dredger Order for Port Glasgow

The Mersey Docks and Harbour Board have placed an order with Ferguson Brothers (Port Glasgow), Ltd., for a twin-screw grab hopper dredger, which will be similar in size to the Mersey No. 26 and Mersey No. 27, (each of 1363 tons gross), built at Port Glasgow in 1948 and 1949 respectively. The dredger will be equipped with three electrically-operated grab dredging cranes each with a capacity of 70 cu. ft., manufactured by Priestman Bros. Ltd., Hull. Diesel propelling machinery will be situated aft.

New Self-Loading Pallet Trailer

The transport of goods on pallets or stillages by means of pallet or stillage trucks is most economical over short distances. For distances exceeding about 100 yards, transport by tractor-trailer train becomes cheaper, in terms of cost per ton-mile moved. Pallet or stillage trucks are, however, often run over uneconomically long distances to avoid the need for loading and unloading the trailers by fork truck.

To free fork trucks from this duty, there has recently been introduced a new self-loading pallet trailer. This consists essentially of a pair of forks with a hydraulic jack, mounted within a trailer chassis which is open at the rear. .The trailer is manoeuvred by hand until the wheeled side arms straddle the load and the forks, in the lowered position, slide under the pallet. A few strokes on the hand pump raise the forks off the ground and elevate the load, so that the trailer with its load is ready for towing.

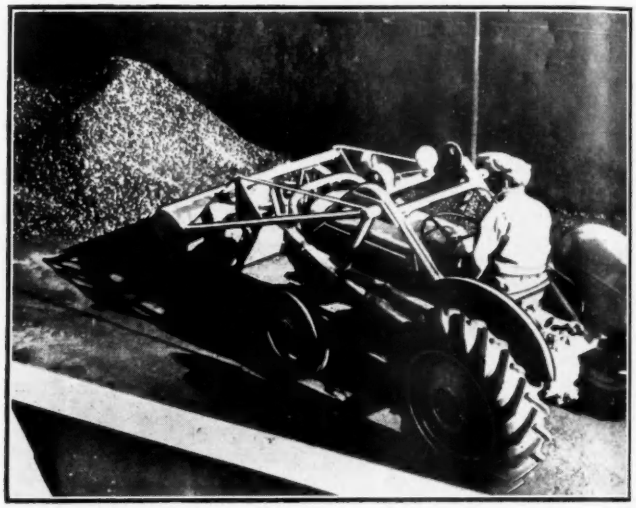
The robust handle can be used both for manoeuvring by hand and for towing by a tractor.

Each trailer is fitted with a bar hinged at the rear end of one of the side arms. When the load is picked up, this bar is swung across and secured on the other side arm by means of a heavy pin. At the centre of the bar is a towing bracket by means of which further trailers can be coupled up. The bar also serves to bridge the gap at the rear of the trailer and to prevent the load from slipping off on steep inclines.

The trailers are of strong fabricated box construction and have a load capacity of 1 ton. The lift of the forks is 6-in., so that stillages as well as pallets up to 48-in x 48-in. can be handled. The three wheels have pneumatic tyres, the front wheel being pivoted. This arrangement results in a very small turning radius and gives the trailer excellent manoeuvrability. These trailers are manufactured by Messrs. Lansing Bagnall Ltd., Basingstoke.

Tractor for Trimming Ships' Holds

At an American Port recently, a further use was found for the versatile Ferguson Tractor, which was employed for trimming ships' holds. The crane grab bucket, used for unloading coal, was unable to clean out the corners of the hold, and in the past it



took several men with shovels to finish the job. Now the crane is used to lower into the hold a tractor equipped with a special attachment which enables the work to be completed quickly and efficiently.

New Conveyor for Restricted Spaces

The prototype conveyor which was exhibited at the British Industries Fair, Castle Bromwich, by Messrs. G. R. Turner Ltd., Nottingham, is another milestone on the road to mechanical handling. The main feature of this conveyor is its flexibility as it can negotiate curves as well as being an elevator. In the main the conveyor consists of a chain formed from a series of links each connected to one neighbouring link by a vertical pivot and to the other by a horizontal pivot with supporting wheels mounted on the latter and guide wheels on the former. Detached to the chain is a series of trays which are approximately rectangular in sections but overlap the pivots in such a way that the overlapping portions are partly cylindrical. The chain and the trays are mounted on a light structure which carries the guide track and provides the necessary support. The prototype exhibited has a capacity of 350 tons per hour and is capable of negotiating a bend in the horizontal plane down 9-in. radius to the centre of the conveyor and of negotiating a bend in the vertical plane to 8-in. radius. This conveyor is powered by two 45 h.p. motors in tandem and travels at a speed of 200-ft. per minute. Provided there is no vertical lift such a conveyor could have a length of 700/750 yds. without a boost drive. Messrs. G. R. Turner's conveyor is a solution to the problem of lay-out when the space is restricted and where there is no straight run such as one would find in a newly-constructed factory or warehouse. A modification of the layout could be provided by branches to the conveyor so that materials handled could be diverted as required into various channels. The whole apparatus can be readily dismantled and re-erected in a different layout to suit conditions elsewhere. The trays may be of stainless steel, a moulded rubberised compound, or of plastic.

Manufacturers' Announcements—continued

The Adaptability of 'Unimer' Buildings

A good example of the adaptability of "Unimer" Tubular Steel Buildings is to be seen at Spillers' Millennium Mills, Victoria Docks, London, E.16. Here, there were two existing "Unimer" buildings that were used for storage purposes, one of a 33-ft. span, and 60-ft. in length, and the other being a Triple-span building, 45-ft. in length which incorporated an 18-ft. truss. It was found that an annexe to the animal food building was required for storage and loading out facilities. Consequently, the two existing buildings were taken down and re-assembled to form the first or top floor of this annexe. There were some components remaining after the floor had been constructed which were conveniently used to form the enclosed loading bays that were required. The ground floor of the annexe was designed and constructed in traditional steelwork to support the "Unimer" structure and also a floor load of 2 cwts. per sq. ft.

The loading out floor of the main building was made accessible to the first floor of the annexe by making doorways in the walls. This increased the capacity of the loading out operation by introducing three more chutes which serve the three new loading out bays. The ground floor of the annexe is to be used for palletised storage, and there are also increased facilities for loading out.

The building was economical to construct. Taking into account the fact that the steelwork had to be bought to support the adapted "Unimer" construction on the first floor, the saving was about 50 per cent., therefore costing half the price of a new two storey building.

The building was designed by J. Bradshaw, M.I.Mech.E., Chief Engineer at the Spillers' Mills, and the materials were supplied and erected by B. Finch & Company, Ltd., who are "Unimer" distributors.

Fork-lift Truck Development

It is only in the 10 years since the end of the Second World War that the fork-lift truck system of materials handling has become widely accepted. Generally speaking the design of fork trucks to date has usually confined these machines to operatoin on reasonably good floors and level ground. There have been some recent designs of fork trucks capable of working on unmade roadways and open storage sites, but these can seldom be considered for fast travel between dispersed operating areas.

The lastest machine developed by Conveyancer Fork Trueks Ltd., is known as Conveyancer Overlander. It is a fork lift truck in the accepted sense, and it can operate under such conditions as would often be met by public works contractors at home and abroad, in timber yards and open storage sites, on harbour installations, marshalling yards, in oil fields and other out-lying areas which frequently have need for the handling of materials and equipment over long distances and open country. At the same time the design of the Overlander is such that it may travel on the roadways at over 30 miles per hours.

The Overlander is a four-wheel vehicle equipped with large diameter pneumatic tyres and powered by a six-cylinder diesel engine. Transmission is by a torque converter, of the hydraulic type, through a pneumatically-controlled epicyclic gearbox. Also fitted is an auxiliary gearbox which is so arranged to permit selection of four "forward" and one "reverse" speeds in either direction. That is, as a road vehicle the Overlander has four speeds and one reverse speed. When operating as a fork lift truck the appropriate selection of gears can provide four forward speeds and one reverse speed. The "road" forward speeds are higher than the "stacking direction" speeds.

The stacking unit fitted to the Overlander is of conventional pattern with the usual 2:1 lift feature. The lifting mast can be tilted forwards and backwards; lifting and tilting operations are hydraulically controlled by hydraulic jacks; fluid pressure for which is provided from an hydraulic pump mounted on the transmission unit. The lifting mast incorporates a roller mounted carriage which is designed to carry the lifting forks and, alternatively, a crane arm or other attachment can be fitted.

Steering is power assisted by hydraulic booster jacks, and the design of the steering is such that four wheel or two wheel steering may be selected to suit either fork lift truck duties or road travel duties.

A further interesting feature is the built-in equipment for tyre inflation control. Bearing in mind the need for differing tyre pressures for road, rough country and soft ground operation, this feature permits tyre pressures to be varied at will. Provision is made for a simple plug-in to the tyre valve, beyond which all that is required is operation of the inflate or deflate selector. The resultant pressure can be read on a pressure gauge fitted for this purpose.

On tests so far conducted Overlander has ridden through loose sandy surfaces, soft muddy surfaces and extremely rough loose tracks, and it is anticipated that the development will answer a long felt need for certain types of work.

New Dredger for Calcutta

Wm. Simons and Co., Ltd., Renfrew, Scotland, have secured a contract to build a large and powerful dredger for the Calcutta Port Commissioners. The contract which is valued at about £1 m., was obtained in the face of intense competition from European and more particularly Japanese shipyards. The new vessel, which will be built under the supervision and inspection of Messrs. Rendel, Palmer and Tritton, consulting engineers to the Calcutta Port Commissioners, will be a seagoing drag suction hopper dredger able to clear 3,000 tons of sand from the bed of the Hooghly in 40 minutes, working against a very strong current on the bar which in spring tides sometimes reaches 8 knots.

The present vessels in the fleet at Calcutta were all built by Messrs. Simons, whose connection with the Commissioners extends over a period of 50 years. This new order will help in some measure to maintain the prestige of British shipbuilders in the Far East.

New Crossley Films

Crossley Brothers Limited, Manchester 11, have added two new issues to their already extensive range of films. The new films are "Ocean Highway," covering the application of Crossley Diesel Engines to marine propulsion and auxiliary duty, and "Power for Industry—Part One" showing the world-wide use of Crossley and Crossley-Premier engines in a great variety of industrial installations.

These films will be available later in the year to industry, technical institutions and similar learned societies, or they may be viewed at the London Office of Messrs. Crossley Brothers Limited, or the works at Openshaw.

Dewhurst and Partner Ltd., announce that with affect from Monday, August 1st, 1955, a Branch Office at 56-58 Barton Street, Gloucester (telephone number Gloucester 25613) will be operational. From this office their business activities for the South Wales and Western Areas will be conducted by Mr. R. F. Burrows, who has been appointed Branch Manager.

WANTED

DUMB HOPPER BARGE, for which the owner has no further use, required for testing purposes. Condition of bottom doors is immaterial, but reasonably sound hull required. Send full particulars and price to Box No. 171, "The Dock and Harbour Authority," 19, Harcourt Street, London, W.1.

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Ransomes and Rapier 8½-tons capacity Mobile "Super" type Crane. Standard type jib. Solids. Diesel or petrol.
Lorain 7½-tons capacity Lorry mounted Crane, type TMC3. 40-ft. jib. Diesel powered.
Cole/Thornycroft Lorry mounted 5-ton Cranes. Petrol/Electric. Pneumatics.
Coles Mobile. Model 90079. 5-tons capacity. Self propelled. Pneumatics. Diesel.
Coles Mobile. 2-tons capacity. 17-ft. jib. Pneumatics. Diesel.
Coles 1-ton capacity Mobile Crane, self propelled. Model 8506, 21-ft. jib. Pneumatics.
Cranemobile Mobile Crane. 4-tons capacity. Petrol. Pneumatics. Very fast.
Hyster Karry Kranes. 4-tons capacity. Solid or pneumatic tyres. Diesel or petrol powered.
Neals Mobile Cranes, type N and NM. 2-tons capacity. Pneumatics. Diesel.
Jones Super 22 Crane. 25-ft. Lattice jib. Pneumatics. Diesel powered.
Taylor Jumbo Crane. 2/3 tons capacity. Hydraulic luffing. Perkins P6. Pneumatics. (1¼ cu. yd. Grab available for above.)
Taylor Hydracrane. Mounted on Morris 4 f.w.d. chassis. Pneumatics. Excellent condition.
Cranemaster 2-tons capacity Crane, operated on "Case" pneumatic tyred Tractor. T.V.O.
Stanhay 1-ton capacity Crane. Petrol. Mounted solid tyres.
TD9 Tractor Crane. Fitted Gooseneck telescopic jib.
Chatteris Electric Luffing Crane, 1-ton capacity. 45-ft. radius.
Grafton 2-ton Steam Crane. Fully slewing. 30-ft. jib.
10-cwt. Wall Crane. 7-ft. 8-in. outreach.
10-tons capacity Derrick Crane. 100-ft. jib. 400 volts A.C.
Jules Weitz Tower Crane. Type G12. 2-tons capacity. 65-ft. jib.

For further details apply: Chamberlain Industries, Ltd., Staffa Road, Leyton, E.10. Tel.: LEYtonstone 3678.

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The Port of London Authority invite applications for positions as ASSISTANT ENGINEER at a commencing salary of £1,075 rising by annual increments to £1,425 per annum.

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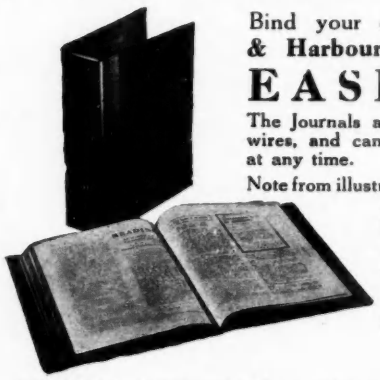
Application forms may be obtained from the Establishment Officer, Port of London Authority, Trinity Square, London, E.C.3.

E. S. BIRCH, Secretary.



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CRANE FOR SALE

Sealed bids for the purchase of 250-ton Floating Crane U.S. AJAX and one lot of spare parts, offered for sale under Invitation 179 by Panama Canal Company will be received until 10.30 a.m. Eastern Standard Time September 30, 1955. The U.S. AJAX still classed as one of the largest floating cranes of its type was manufactured by Deutsche Maschinenfabrik A.G. of Duisberg, Germany, and floated to the Canal Zone in July, 1914, on a trip which took 74 days. The general condition of the hull and superstructure is sound and good; finish and upkeep excellent. Detailed specifications concerning the floating crane offered under this invitation may be obtained along with bid forms, by application to Procurement Officer, Panama Canal Company, 21 West St., New York 6.